LARGE SYSTEMS USER REQUIREMENTS

INPUT

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Large-Systems User Requirements

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Abstract

This report analyzes the service and support requirements of users of the following large systems: Amdahl 58XX, Control Data Corporation Cyber 180 and 170, Bull H.N. DPS 8, IBM 309X, IBM 308X, National Advance Systems AS, NCR 93XX, Unisys A-Series, and Unisys 1100/XX. Each individual user group is analyzed separately, and the entire large-system user sample is analyzed as a group in order to provide an industry standard.

Each individual vendor/product analysis begins with a discussion of the typical service contract coverage reported by that vendor's users. Next, user requirement for and satisfaction with traditional service measurements of system availability, response time, and repair time are analyzed in depth, comparing 1989 satisfaction levels with previous years' findings. Immediately following is an analysis of user satisfaction in the pre- and post-sales support areas of hardware maintenance, software support, and ancillary service (composed of preinstallation planning, consulting, installation, network design, and maintenance-related user training). Following is a discussion of user experience and contact by third-party maintenance, including reasons why the user stayed with the manufacturer. Each analysis concludes with a summary of strengths and weaknesses as reported by the users, as well as any service opportunities requested by the users.

The report itself is broken into five chapters. Chapter I provides an introduction to the report. Chapter II is an executive overview that summarizes the key findings of this study. Chapter III provides an analysis of large-systems user service requirements of all vendors and provides an industry standard to compare individual vendor performance. Chapter IV contains individual vendor performance analyses, measuring each vendor's performance with respect to their own users' requirements. Chapter V contains large-systems summary data in an exhibit form that allows quick comparison of vendor performance. Appendixes at the end of the report provide an example of the questionnaire used in data collection for this study, as well as a list of definitions of terms used in this report.

The report contains 141 pages, including 117 exhibits.

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I

Introduction

I

Introduction

The following report, entitled *Large-Systems User Requirements*, is the first of three deliverables for clients of the large-systems module of INPUT's 1989 Customer Service Program. The second report, *Service Vendor Analysis—Large Systems*, will analyze the service operations of leading large-systems service vendors. The last report, *U.S. Customer Service Market*, will provide both current market sizing and five-year forecasted growth for the large-systems service market.

This report analyzes large-system user requirements for and satisfaction with the service and support that they require. Rather than acting as a simple analysis of user satisfaction, this study hopes to uncover opportunities for growth in areas where the user requirement for service exceeds the service currently received. These areas may help improve user satisfaction with both the service and the product itself, and also provide opportunities for revenue growth.

A
Scope

This report analyzes the service requirements of users of the following large systems: Amdahl 58XX, Control Data Corporation Cyber 180 and 170 systems, Bull H. N. Information Systems DPS mainframes, IBM 309X and 308X systems (analyzed separately), National Advance Systems (NAS) AS large systems, NCR 93XX small mainframes, and Unisys A-Series and 1100/XX mainframe lines (also analyzed separately). Exhibit I-1 provides a breakdown of the large-systems sample by vendor and model.

Each individual vendor/product analysis begins with a discussion of the typical service contract coverage reported by that vendor's users. Next, the user requirement for and satisfaction with traditional service measurements of system availability, response time, and repair time are analyzed in depth, comparing 1989 satisfaction levels with previous years' findings. Immediately following is an analysis of user satisfaction in the pre-

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EXHIBIT I-1

LARGE-SYSTEM SAMPLE BY MANUFACTURER

Manufacturer	Model	Number of Surveys
Amdahl	58XX	44
CDC	Cyber	45
Bull H. N.	DPS	45
IBM	3090	41
IBM	308X	39
NAS	4S/XL	40
NCR	9700	40
Unisys	A	40
Unisys	1100/XX	40
Total		374

and post-sales support areas of hardware maintenance, software support, and ancillary service (composed of preinstallation planning, consulting, installation, network design, and maintenance-related user training). Following is a discussion of user experience and contact by third-party maintenance, including reasons why the user stayed with the manufacturer. Each analysis concludes with a summary of strengths and weaknesses as reported by the users, as well as any service opportunities requested by users.

The report itself is segmented into five chapters. Chapter I provides an introduction to the report. Chapter II is the Executive Overview that summarizes the key findings of this study. Chapter III is the analysis of large-systems user service requirements—all vendors, which provides an industry standard to compare individual vendor performance. Chapter IV contains the individual Vendor Performance Analyses, which meas-

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ure each vendor's performance with respect to their own users' requirements. Chapter V contains large-systems summary data in an exhibit form that allows quick comparison of vendor performance. Appendixes at the end of the report provide an example of the questionnaire used in data collection for this study, as well as a list of definitions of terms used in this report.

B
Methodology

For this report, INPUT surveyed 374 users of large systems to determine their requirement for and satisfaction with the service that they received. Each of these interviews (using the questionnaire found in Appendix A at the end of this report) was conducted by telephone, and each lasted approximately 30 minutes. INPUT targets the appropriate information systems executive at each company; typical titles of respondents are Data Processing Manager, MIS Manager (or Director), or Computer Operations Manager. Companies from a wide range of industries were surveyed, as shown in Exhibit I-2; however, the size and cost of such systems required the sample to be made up of predominantly Fortune-500 size companies.

INPUT emphasizes the value of telephone surveys over other types of research-gathering practices (i.e., mail surveys, focus research groups) because phone surveys provide the ability to control the sample size and source of research information.

After the survey process is completed, the survey data is subjected to rigorous quality control activities prior to data entry. Survey results are then entered into a dBASE III Plus (Ashton Tate Corporation) data base, run through additional quality control tests, and then analyzed using a statistical analysis program called ABstat (Anderson Bell). During the final statistical analysis, additional quality-control tests are performed to ensure data integrity.

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EXHIBIT I-2

LARGE-SYSTEM USER SAMPLE BY INDUSTRY

Industry	Number of Interviews
Education	60
Process Manufacturing	58
Services	53
Discrete Manufacturing	36
State & Local Government	30
Banking and Finance	21
Medical	18
Transportation	18
Federal Government	15
Insurance	15
Retail	13
Other Industry-Specific	13
Utilities	11
Wholesale	9
Telecommunications	4
Total	374

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II

Executive Overview

II

Executive Overview

The Executive Overview is provided as a convenient summary of the main points of this report. It is presented in a format that facilitates the use of this section as a short presentation, with each exhibit accompanied by text that acts as a script detailing the key findings of the study.

INPUT has been tracking the service and support requirement and satisfaction level in the large-system market (in this format) since 1983. During this period, INPUT has seen opposing pressures of increased demand for increased system availability and improved service quality, while at the same time increased user demand for more-affordable support. As a result, vendors have had to redefine service and support functions, and, more importantly, attempt to maximize service productivity by concentrating on key service requirements.

At the same time, service vendors continue to look for new service opportunities that will increase user satisfaction and provide new revenue sources. These efforts have helped expand the definition of service and support beyond traditional remedial hardware maintenance to include such areas as consulting and network design.

A

Service Quality Far Outweighs Price

In the past, INPUT has queried users of third-party maintenance service about the reasoning behind their decision to switch to third-party service over their original manufacturer-supplied service. Usually, service quality issues ranked higher than pricing concerns, yet the two issues were typically fairly close in importance to users of all system types.

In 1989, INPUT surveyed 374 users of large systems to find out, among other things, why they stayed with their current (manufacturer) source of service. As shown in Exhibit II-1, the large-system users, much like the third-party maintenance users, rated service quality as the most important factor in their decision. The two groups of service customers vary significantly on the importance of price. The manufacturer-based large-

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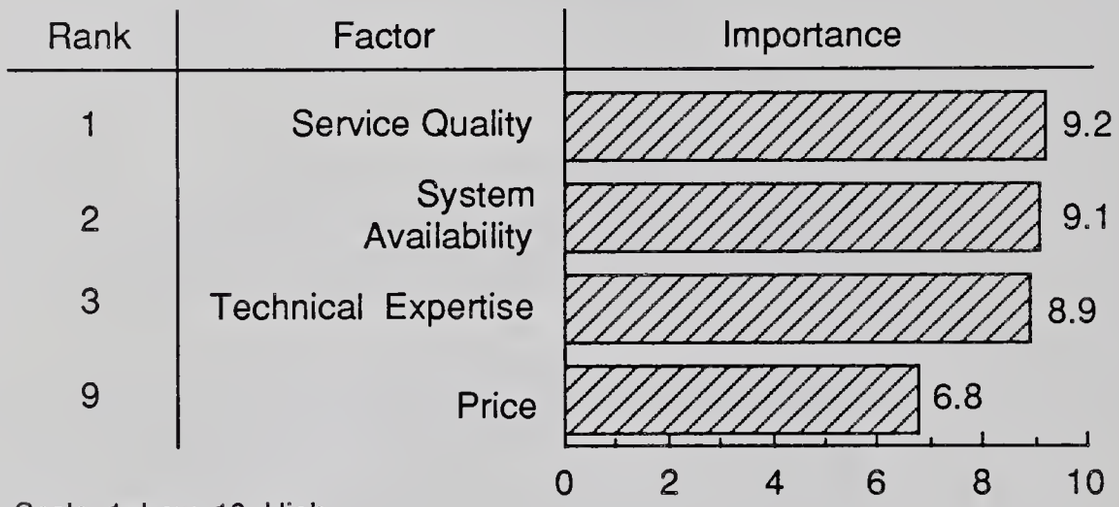
systems users place relatively little importance on service price, which is ranked ninth (out of a list of ten) factors analyzed.

EXHIBIT II-1

SERVICE QUALITY RANKS HIGHEST AS REASON FOR STAYING WITH MANUFACTURER



Scale 1=Low, 10=High

Traditionally, the large-systems service market has been a particularly tough market for third-party maintenance vendors to penetrate. INPUT estimates that third parties captured only 8% of the total large-systems service market in 1988. Many factors may contribute to a large-systems user's hesitancy to switch to third-party maintenance; however, the most important factors are all service quality related (system availability, technical expertise, access to spare parts, etc.). The traditional sales pitch for third-party maintenance is often a lower price.

The large-systems manufacturers, led by industry leader IBM, even weakened the lower-price approach of TPMs by announcing significant price reductions in the form of long-term discount plans (i.e., the Corporate Service Amendment), which made it difficult for TPMs to reduce their service prices to levels significantly below manufacturer levels. Thus, the perceived service quality benefit associated with manufacturer-based service, along with the manufacturers' own service price reductions, will certainly deter significant TPM growth in the large-systems market.

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B

Traditional Service Performance Improves

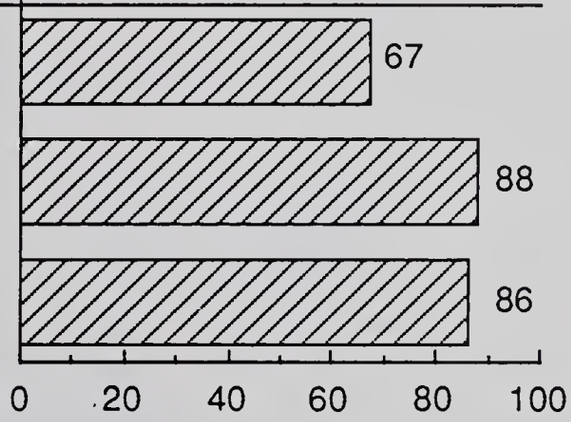
Service vendors have traditionally measured service performance in terms of system availability (equal to the total time that a system is scheduled to operate minus system down time), service response time (traditionally measured as on-site response time; however, with the rise in telephone support and remote diagnostics, now defined as the time required from the point when the user contacts the vendor to the time that the user perceives that the vendor is working on the problem), and repair time.

Exhibit II-2 indicates that large-system vendors' mean performance met, and to some extent exceeded, the users' requirements in all three areas in 1989. As a result, user satisfaction in all three areas was quite high, particularly in the areas of response and repair time. Furthermore, the percentage of large-system users who were satisfied with the system availability they received increased from 62% in 1988 to 67% in 1989. A more detailed analysis of system availability satisfaction will follow.

EXHIBIT II-2

TRADITIONAL SERVICE PERFORMANCE IMPROVES

Performance Criteria	Required	Received	Satisfied (Percent)
System Availability (%)	97.8	97.9	67
Response Time (Hrs)	2.3	2.0	88
Repair Time (Hrs)	2.8	2.5	86



Many factors may have contributed to improved performance (including improved logistics, increased use of remote support, and improved training of field engineers), yet one observation that has to be pointed out is a definite decrease in user expectations in each of these areas, which helped make user objectives easier to meet.

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From this exhibit, it is obvious that user satisfaction increases as user requirements for system availability levels decline. Prior to 1989, large-system users, in fact all system users, reported steadily increasing requirements for system availability. For example, in 1988 39% of the large-system users reported system availability requirements of 100%, while 69% of the same sample reported system availability requirements of 99% or higher.

To continue to meet the needs of high-system-availability customers, large-systems vendors will have to contend with such competing issues a rising spare costs, the need to have quickly accessible parts and faster response times, and the need to control costs (including labor). To be successful, vendors will need to continue to increase service automation (call handling and dispatching, parts inventory, diagnostics, and remote support delivery).

D

Shifts in System Availability Satisfaction Leaders

Since large-systems users place such a high priority on systems availability, perhaps the most important achievement that a large-system vendor can accomplish is satisfying as many of its users (with respect to systems availability) as possible. It is important to emphasize that the attainment of the highest system availability by itself would be a hollow achievement if the users of that system require even higher system availability.

Exhibit II-4 ranks the large-system vendors by the percentage of their 1989 user sample that was satisfied with the system availability they received. The most substantial changes in positioning from 1988 to 1989 were made by IBM, Control Data Corporation (CDC), National Advance Systems (NAS), and Amdahl.

Companies that dramatically increased user satisfaction with system availability were IBM, particularly for users of its older 308X large systems; and CDC, for users of its Cyber 170 and 180 systems. IBM 308X system availability satisfaction was increased by a marked improvement in system reliability (shown by a reduction in system interruptions from 2.0 per month in 1987, to 1.2 per month in 1988, to 0.5 per month in 1989). CDC's increase in user satisfaction also stemmed in part from improved system reliability (system interruptions per month dropped from a mean of 2.3 per month in 1987 to 1.0 per month in 1989). It must be pointed out that CDC also benefits from user-reported system availability requirements (96.7% in 1989) that are very "achievable."

Two companies saw significant drops in the percentage of users satisfied with system availability. Ironically, both companies—National Advance Systems (NAS) and Amdahl—have been traditionally associated with reliable systems that provide high system availability.

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C

System Availability Satisfaction Increases

In 1989, large-system users reported that they received system availability of 97.9%, versus an expressed requirement of 97.8%. As stated in the previous section, user requirements for system availability dropped in 1989 (from 98.3% in 1988 to 97.8% in 1989), contributing to increased satisfaction with system availability in 1989, with 67% of the large-systems sample satisfied with system availability (up from 62% in 1988).

Exhibit II-3 presents the percentage of users who require system availability at each requirement level, as well as the cumulative percentage of users who are satisfied at each requirement level. For example, 36% of the 1989 large-systems users surveyed reported that they require 100% system availability. Of those users, the large-systems vendors were able to satisfy 29%. Sixty-two percent of the users require 99% system availability or better, and large-systems vendors were able to satisfy 50% of those users.

EXHIBIT II-3

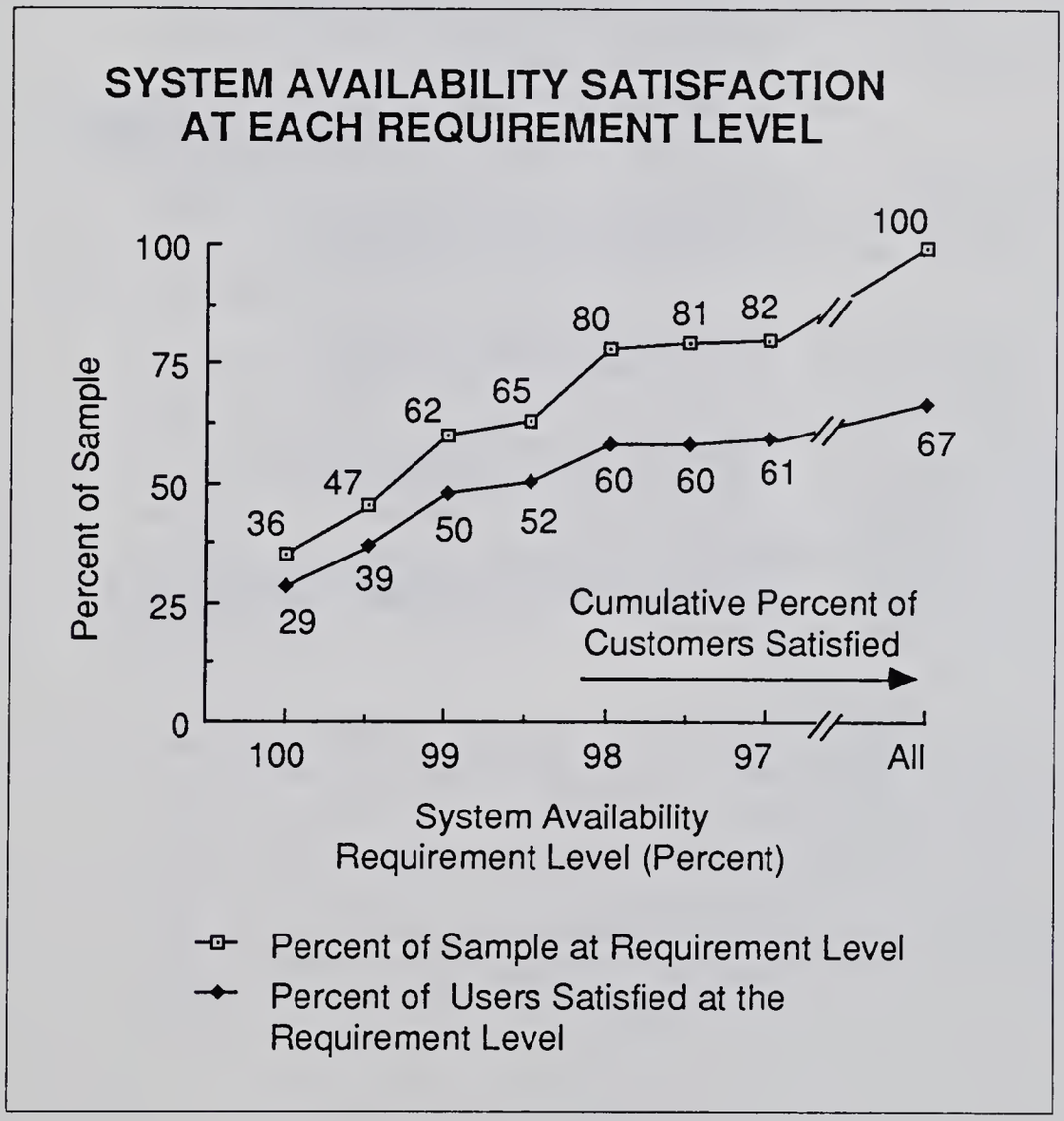

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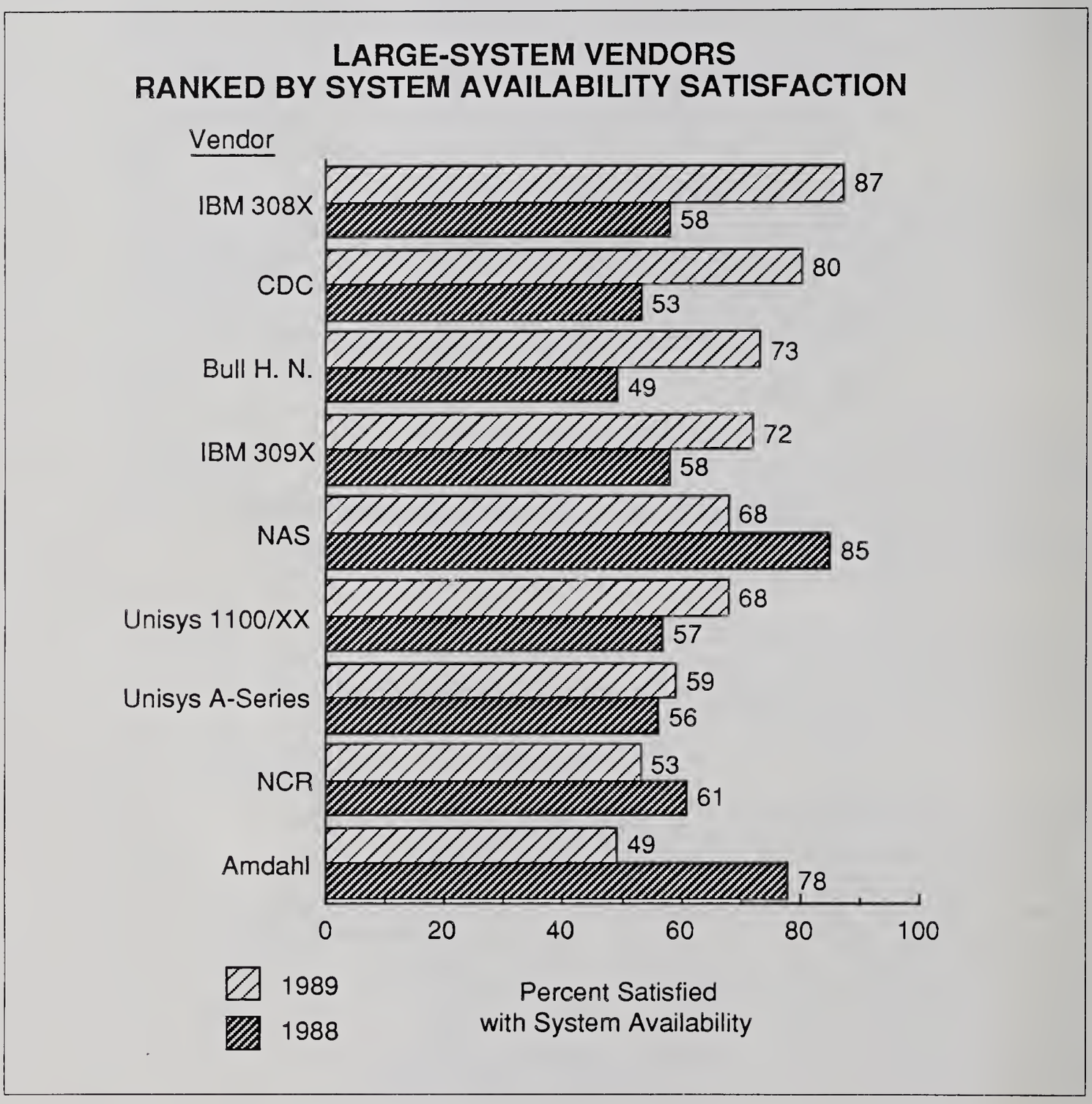
EXHIBIT II-4



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NAS saw satisfaction levels drop from 85% (highest among all large-system vendors) in 1988 to 68% of its users in 1989. Although the number of system interruptions reported by NAS users is extremely low (averaging 0.6 per month in 1989), NAS's ability to maintain high levels of user satisfaction with system availability was hampered by the extremely high expectations of many of its users (45% of the NAS sample reported that they required 100% system availability; NAS was able to satisfy 44% of those users).

Amdahl users also reported that its systems exhibited good reliability (averaging 0.7 system interruptions per month); however, almost half of the 589X users also reported system availability requirements of 100% (Amdahl satisfied only 10% of these users).

E

User Satisfaction with Key Support Services Increasing

In addition to more-traditional measurements of large-system service performance (system availability, response time, and repair time), INPUT analyzed large-system user requirements for and satisfaction with a number of key support services, including hardware maintenance, software support, and ancillary services (which include consulting, planning, network design, and installation services).

Exhibit II-5 indicates that large-systems vendors are able to satisfy a high percentage of users in the areas of ancillary services and hardware maintenance, but are less successful in the area of software support (specifically, software documentation).

In 1989, large-system users' satisfaction with hardware maintenance increased dramatically over previous years' user samples (53% of the large-system users were satisfied in both 1987 and 1988, versus 66% of this year's survey sample). At least part of this increased satisfaction may have resulted from the improved repair times reported in 1989 (averaging 2.5 hours, versus 4.2 hours in 1988). Another contributor may have been increased satisfaction with spare parts availability, which satisfied 53% of the 1989 large-systems users (up from 45% of the 1988 sample).

User satisfaction with software support may have been adversely affected by continued user dissatisfaction with software documentation (with 67% of the large-systems users dissatisfied with the documentation they receive). Although some of the software documentation may be supplied by third-party software developers, the system manufacturer has a vested interest in improving user satisfaction with the documentation, since a user inability to use the documentation frequently results in software problems (and resulting calls for support).

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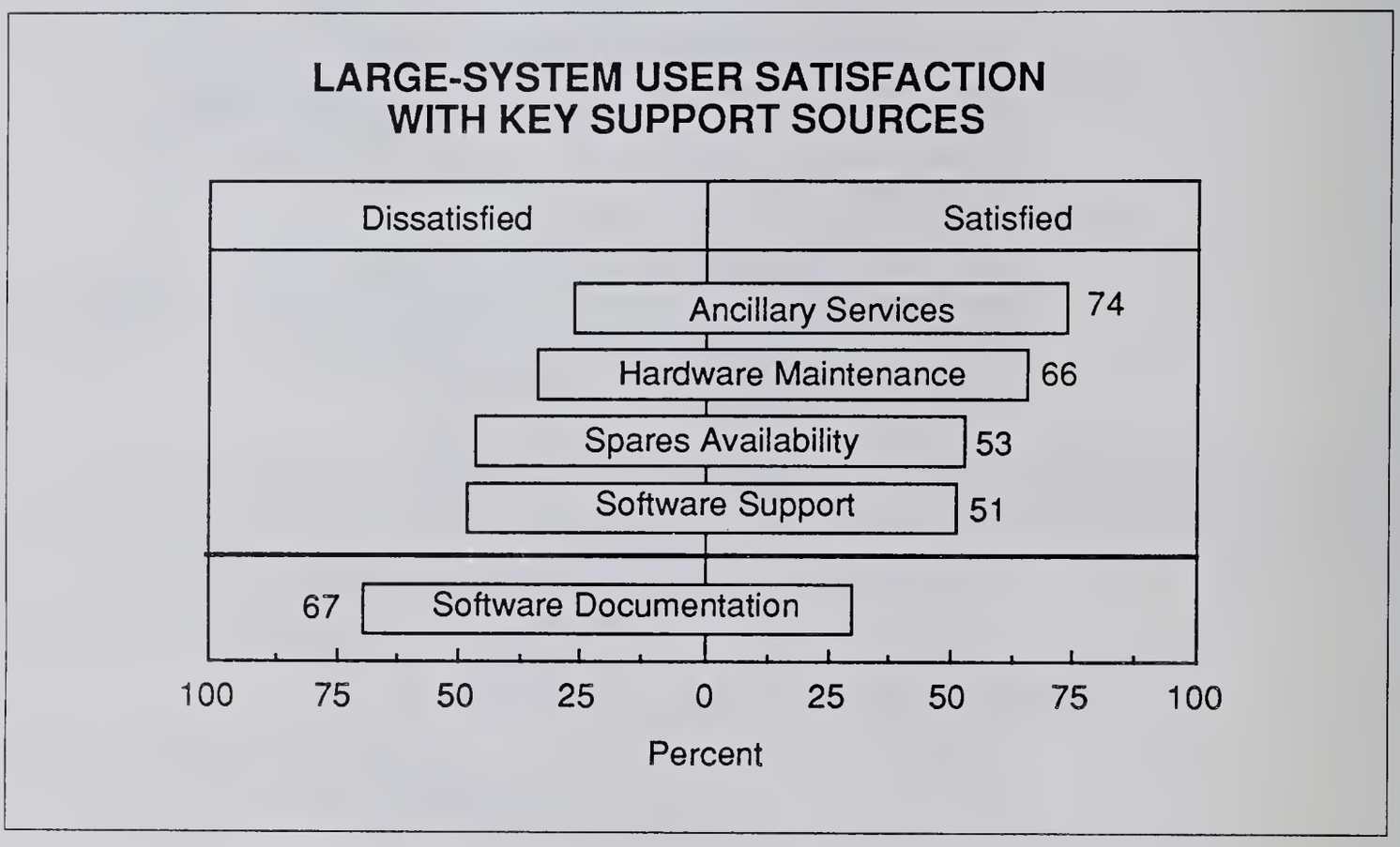
EXHIBIT II-5



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III

Large-Systems User Service Requirements—All Vendors

III

Large-Systems User Service Requirements—All Vendors

In 1989, INPUT surveyed information systems (IS) executives at 374 large-system sites concerning their attitudes toward, and satisfaction with, the service and support they received from their system vendor. The large-system sample was composed of users of the following large systems: Amdahl 58XXs, Control Data Corporation Cybers, Bull H. N. DPS8s, IBM 309Xs, and 308Xs, National Advance Systems AS/XXXXs and AS/XLs, NCR 93XXs, and Unisys A-Series and 1100/XXs. A breakdown of the sample by vendor is found earlier in Exhibit I-1.

Exhibit III-1 shows the results when large-system users were asked to rate the importance of a list of service vendor selection factors. Not surprisingly, large-system users rated service quality and system availability highest when deciding upon their service vendor, with low priority given to service pricing and contract flexibility. With all the discussion about the user need for a single source of support, there was a surprising lack of concern about the ability of a service vendor to service other manufacturers' products, which was rated lowest, well below all other selection factors. Apparently, most vendors already provide sufficient multivendor service, or else most users place greater importance on the original vendor for providing support.

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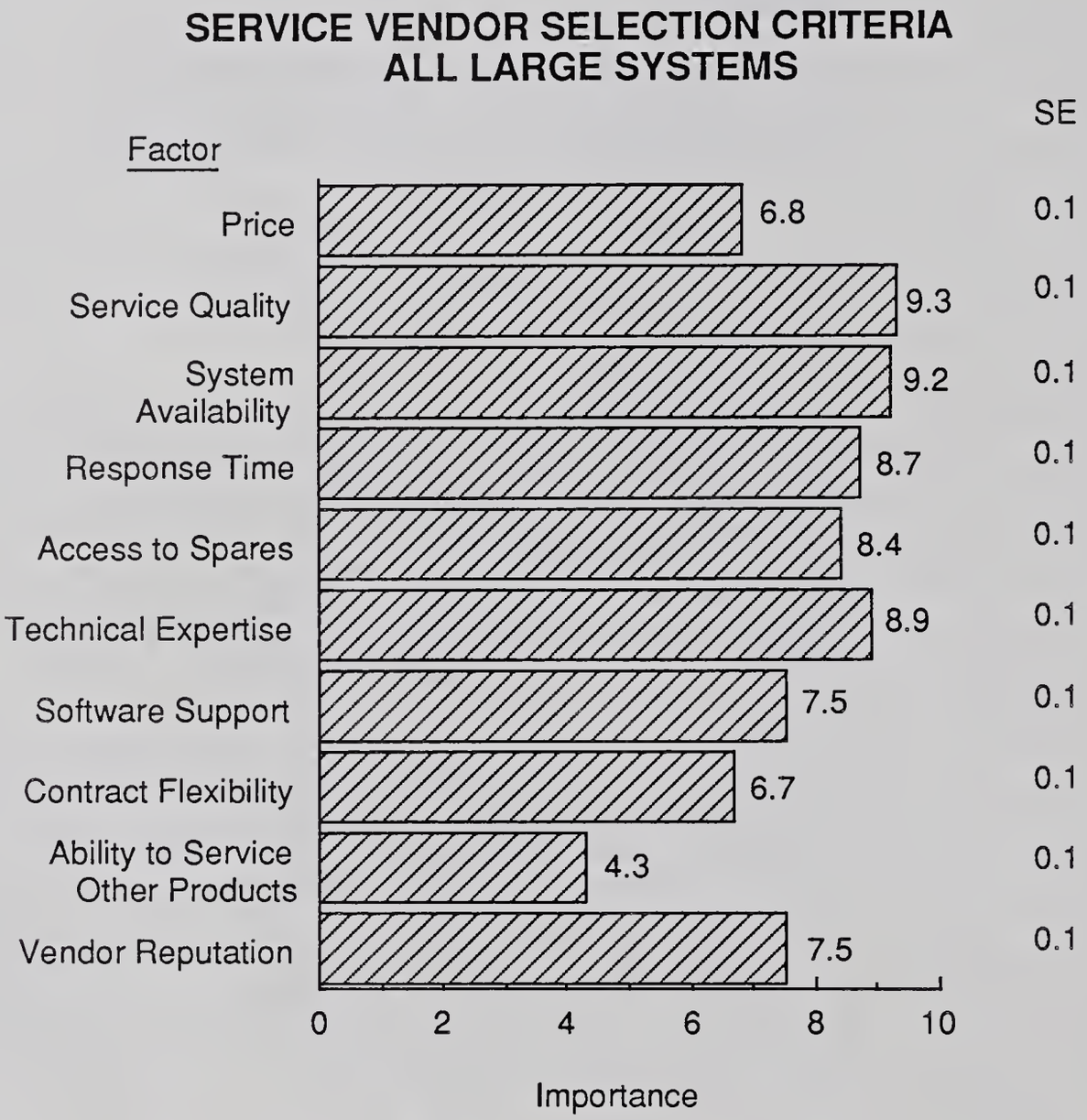
EXHIBIT III-1



SE=Standard Error

Exhibit III-2 provides a breakdown of the typical large-system user's service coverage received under contract from the vendor. In 1989, just over half of the users reported that they received around-the-clock coverage, about the same percentage of users as last year. No other large-system vendor followed IBM's, Amdahl's, and NAS' lead in extending standard service coverage to 24 hours, seven days.

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EXHIBIT III-2

CONTRACT COVERAGE
ALL LARGE SYSTEMS

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	45	46
Monday - Saturday	1	2
Monday - Sunday	54	52
Hours Covered		
1 - 9 Hours	41	34
10 - 16	6	11
16 - 24	53	55

As shown in Exhibit III-3, system reliability improved significantly in 1989, with the average number of system interruptions per month dropping from 1.6 per month to 0.9 per month, an improvement of 44% over last year. Even though hardware problems represented a larger proportion of the system interruptions, the actual mean number of hardware-related system interruptions declined as well (0.8 hardware failures in 1988 versus 0.6 hardware failures in 1989).

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EXHIBIT III-3

SYSTEM INTERRUPTION ANALYSIS
ALL LARGE SYSTEMS
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.9	0.1	1.6	0.1
Hardware-Caused	63	2.2	49	2.1
System-Software-Caused	16	1.5	21	1.4
Application-Software-Caused	5	0.9	11	1.2
Other-Caused	16	1.8	19	1.7

SE=Standard Error

In 1988, system availability requirements were reported at 98.3%, versus actual vendor performance of 97.9%. In 1989, large-system vendor actual performance was constant—as shown in Exhibit III-4—but user expectations for system availability decreased slightly to 97.8%. A possible result was that large-system user satisfaction with system availability, shown in Exhibit III-5, increased from 62% satisfied in 1988 to 67% satisfied in 1989. Response and repair time satisfaction dipped slightly in 1989, even though actual repair time averages reported by the 1989 large-system sample improved from 4.2 hours in 1988 to 2.5 hours in 1989 (on the other hand, response time actuals were slower in 1989).

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EXHIBIT III-4

SYSTEM AVAILABILITY PERFORMANCE ANALYSIS ALL LARGE SYSTEMS

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	97.8	0.2	97.9	0.2
Response Time (Hrs)	2.3	0.2	2.0	0.2
Repair Time (Hrs)	2.8	0.3	2.5	0.2

SE=Standard Error

EXHIBIT III-5

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION ALL LARGE SYSTEMS

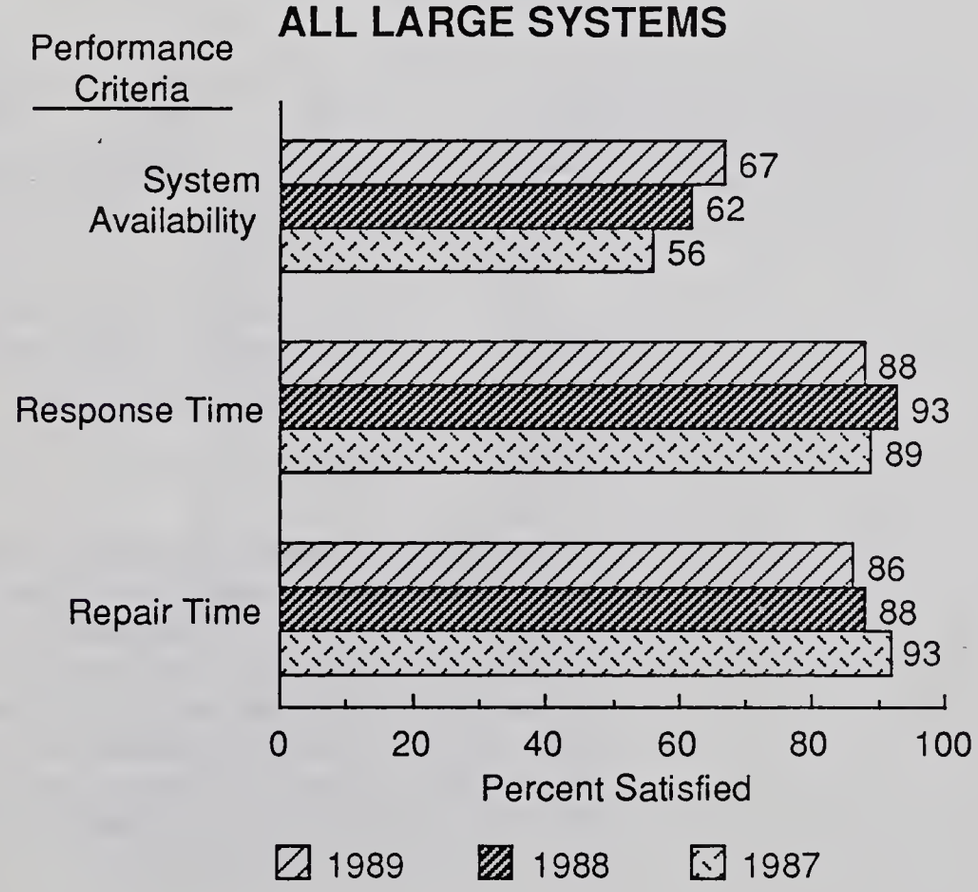

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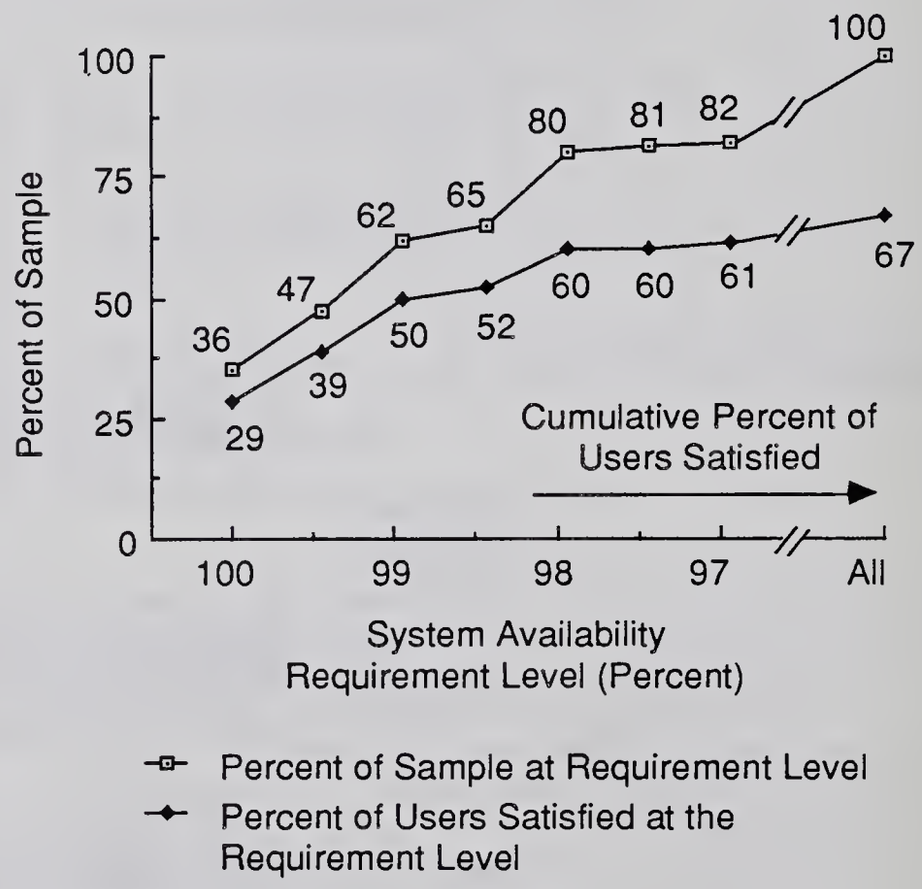
Exhibit III-6 graphically presents the cumulative percentage of users satisfied at each system availability requirement level. Compared to last year's results, the percentage of users with system availability requirements of 98% and above increased from 56% satisfied in 1988 to 60% satisfied in 1989.

EXHIBIT III-6



The large-system users reported highest requirements for hardware engineer skill level, parts availability, and hardware maintenance overall, as shown in Exhibit III-7. Large-system vendor performance in these critical areas improved over last year's results; Exhibit III-8 shows that user satisfaction with HW engineer skill level increased from 60% to 65%, satisfaction with spare availability increased from 45% to 53%, and user satisfaction with HW maintenance overall increased from 53% to 66%. Spares availability continued to be a problem reported by users of Unisys, Bull H. N., and NCR systems.

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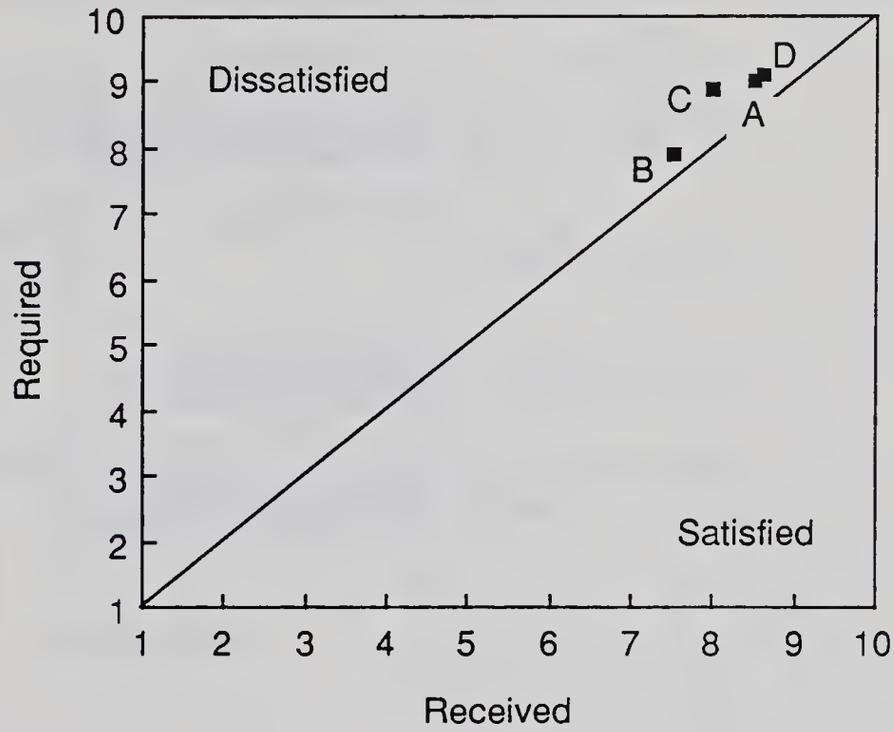
EXHIBIT III-7

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED ALL LARGE SYSTEMS



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	9.0	0.1	8.5	0.1
B	HW Remote Support	7.9	0.1	7.5	0.1
C	Spare Parts	8.9	0.1	8.0	0.1
D	HW Maintenance Overall	9.1	0.1	8.6	0.1

Scale 1=Low, 10=High
SE=Standard Error

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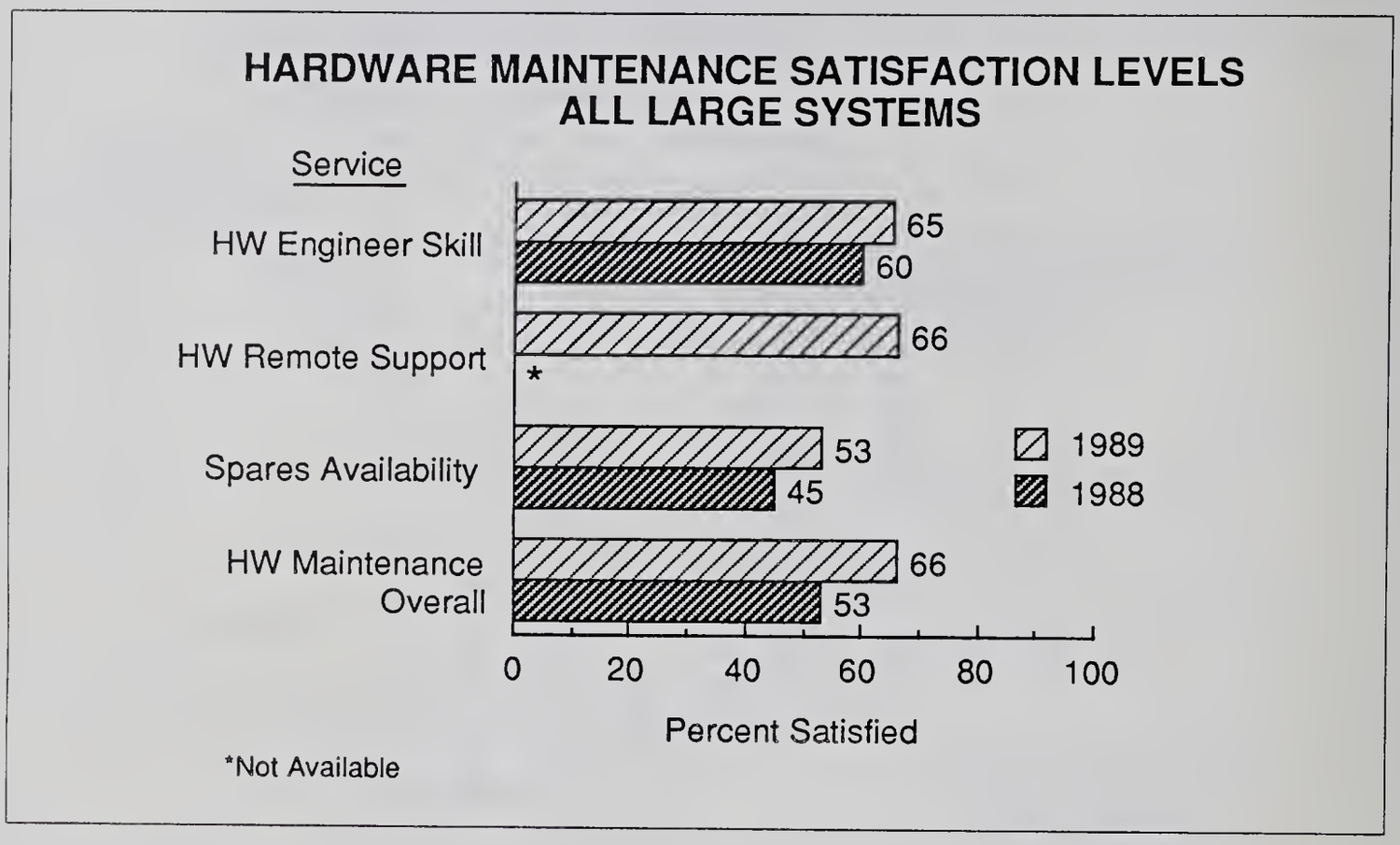
EXHIBIT III-8



Software support performance is analyzed in Exhibits III-9 and III-10. Large-system users rated software engineer skill level most important among all software support services analyzed, yet the one area in which large-systems vendors satisfied the least users is software documentation, where only one-third of large-systems users were satisfied. User satisfaction with most software support services increased in 1989, with the exception of remote support.

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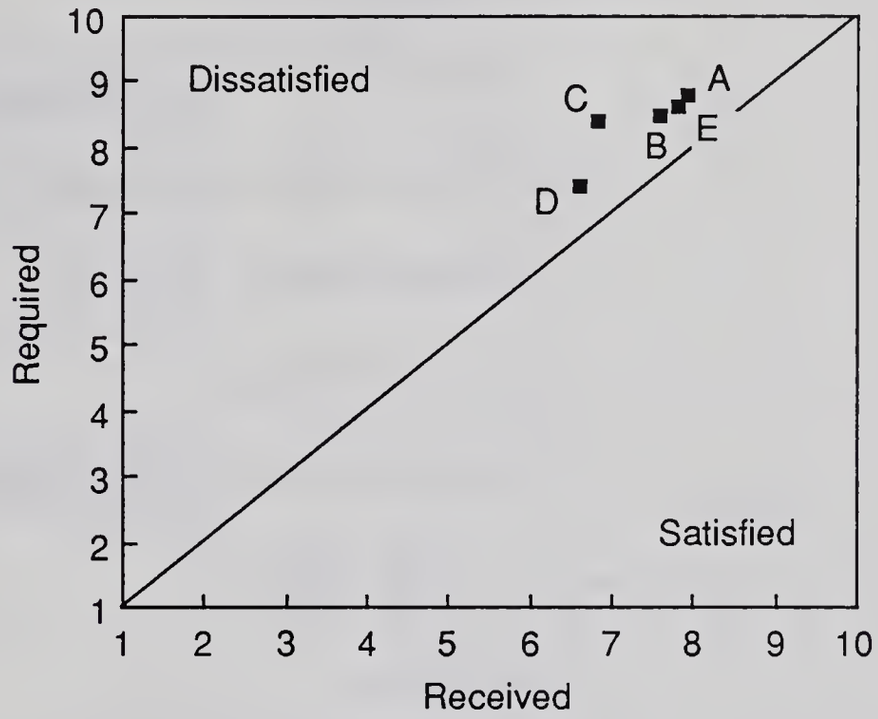
EXHIBIT III-9

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED ALL LARGE SYSTEMS



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	8.8	0.1	7.9	0.1
B	SW Remote Support	8.5	0.1	7.6	0.1
C	SW Documentation	8.4	0.1	6.8	0.1
D	Operational Training	7.4	0.2	6.6	0.2
E	SW Support Overall	8.6	0.1	7.8	0.1

Scale 1=Low, 10=High
SE=Standard Error

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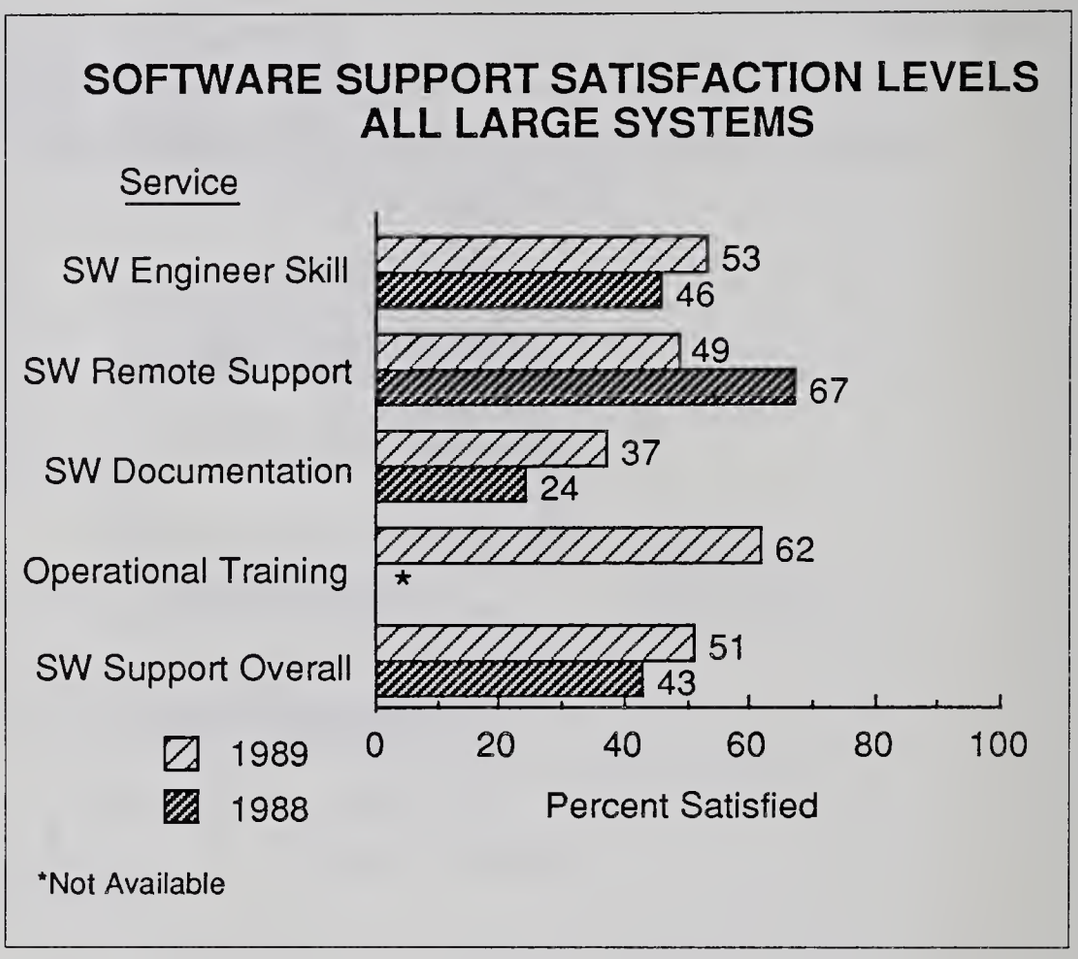
EXHIBIT III-10



Large-system users are beginning to place greater importance on ancillary services that have a direct impact on the serviceability and performance of systems. Exhibit III-11 presents large-system user requirements and received ratings for a number of ancillary services. Large-system users place the highest value on installation planning and implementation services, while showing relatively minor interest in network planning and maintenance-related training.

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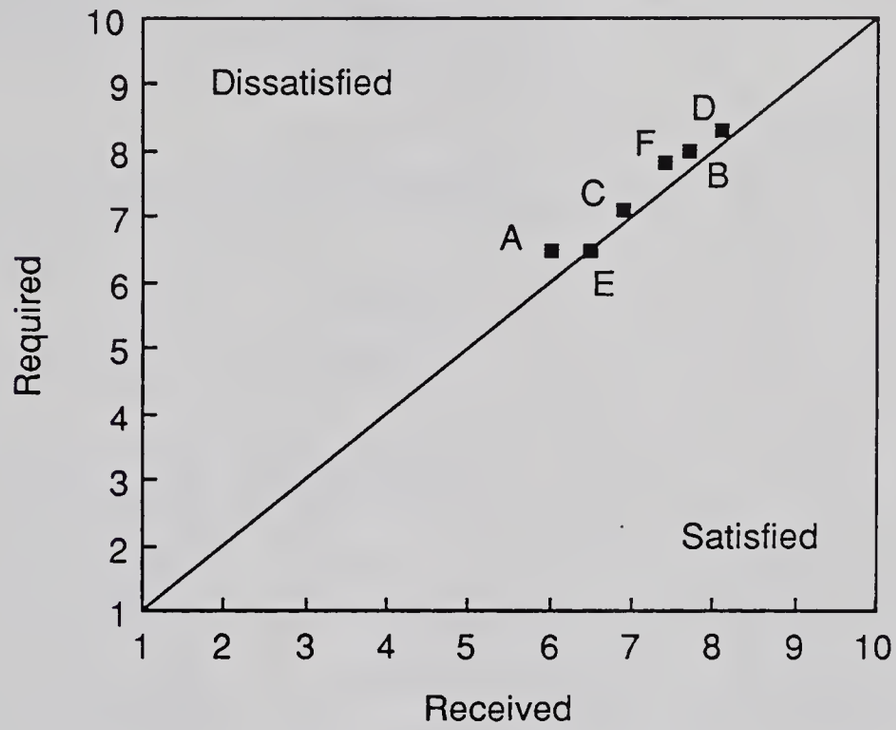
EXHIBIT III-11

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED ALL LARGE SYSTEMS



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.5	0.2	6.0	0.2
B	Preinstallation Planning	8.0	0.1	7.7	0.1
C	Consulting	7.1	0.2	6.9	0.2
D	Installation/ Deinstallation	8.3	0.1	8.1	0.1
E	Network Designs/ Planning	6.5	0.2	6.5	0.1
F	Ancillary Services Overall	7.8	0.1	7.4	0.1

Scale 1=Low, 10=High
SE=Standard Error

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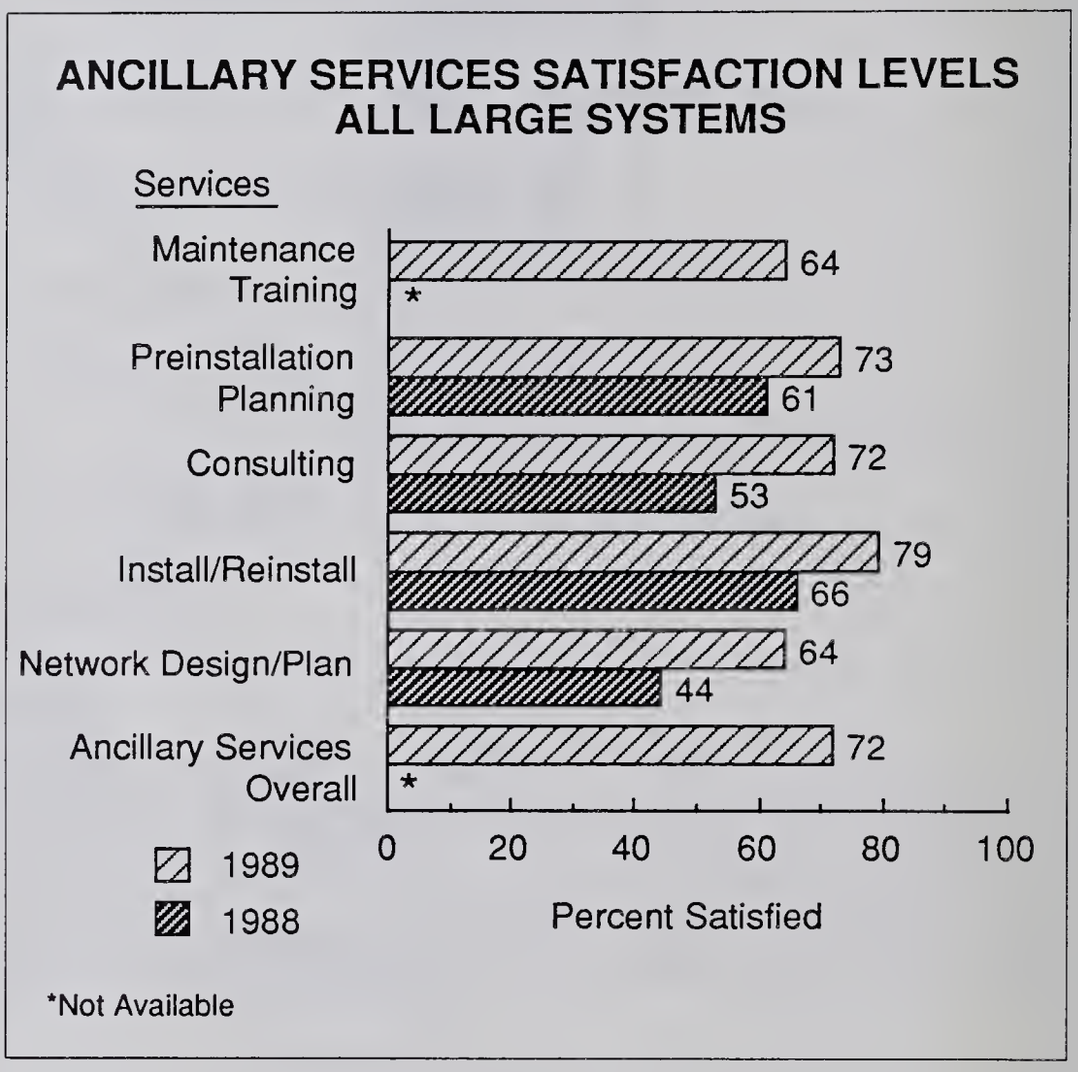
According to Exhibit III-12, large-system users are happiest with installation services performed by their vendor, with almost eight out of ten users satisfied with the support they received in this area. The large-systems users reported the greatest increase in satisfaction came in the area of network planning and design, where the percentage of large-systems users satisfied increased from 44% in 1988 to 64% in 1989.

EXHIBIT III-12



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IV

Vendor Performance Analyses

IV

Vendor Performance Analyses

In this chapter, INPUT will analyze each large-system vendor's service performance individually. Each analysis begins by providing a breakdown of the service contract coverage received by each vendor's sample. In the large-systems market, around-the-clock service coverage has become increasingly common. The individual vendor performance analyses will show whether all large-system vendors are standardizing on seven-day, twenty-four-hour service contracts.

Of course, no analysis of service vendor performance would be complete without a examination of user satisfaction with the traditional measurements—system availability, response time, and repair time. Given the importance of system availability to users in their selection of product and service provider, INPUT believes that service vendors should pay particular attention to this message.

Lastly, each service vendor's performance in the areas of hardware maintenance, software support, and ancillary services (i.e., planning, installation services, consulting, and network design) is analyzed. User requirement for and satisfaction with such critical services (and performance criteria) as spare parts availability, software documentation, and network design is measured in each analysis.

A

Amdahl

In 1989, INPUT surveyed forty-four users of Amdahl systems. This sample can be broken down into the following products: twenty-one 5860s, seven 5880s, seven 5890s, four 5840s, three 5870s, and two 5850s. The sample can be further broken down by the following industries: nine state and local government, eight services, six federal government, four transportation, four discrete manufacturing, three banking and finance, three medical, two process manufacturing, two utilities, and one each from education, wholesale, and other industry-specific.

One example of the premium service offering is shown in Exhibit IV-1, which shows that all Amdahl users received around-the-clock service

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EXHIBIT IV-1

CONTRACT COVERAGE
AMDAHL

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	0	20
Monday - Saturday	0	3
Monday - Sunday	100	77
Hours Covered		
1 - 9 Hours	0	10
10 - 16	0	3
16 - 24	100	87

coverage in 1989.

The reliability of Amdahl systems is demonstrated in Exhibit IV-2, which shows that users reported 0.7 system interruptions per month. This mark represents a substantial drop from last year's figure of 1.1 per month, although the mix of system interruption causes (73% hardware caused, versus 35% last year) did change appreciably.

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EXHIBIT IV-2

SYSTEM INTERRUPTION ANALYSIS AMDAHL (Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.7	0.2	1.1	0.3
Hardware-Caused	73	5.6	35	6.0
System-Software-Caused	13	4.0	25	4.8
Application-Software-Caused	0	0.0	21	5.2
Other-Caused	14	5.4	19	4.9

SE=Standard Error

Amdahl users report extremely high system availability requirements (99.0 %, versus 97.8% for the entire large-system sample), as shown in Exhibit IV-3. Admirably, Amdahl's mean performance in system availability, as well as response and repair time, betters their user sample's reported requirement levels. Unfortunately, a large percentage of Amdahl users expect 100% system availability (49% of the sample), but Amdahl satisfies only 49% of its users in this area, as shown in Exhibit IV-4. This satisfaction level represents a significant drop from 1988 (when 78% of the Amdahl sample was satisfied), but is more in line with what 1987's Amdahl sample reported.

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EXHIBIT IV-3

SYSTEM AVAILABILITY PERFORMANCE ANALYSIS AMDAHL

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	99.0	0.2	99.2	0.1
Response Time (Hrs)	1.5	0.1	1.1	0.1
Repair Time (Hrs)	2.1	0.3	1.7	0.3

SE=Standard Error

EXHIBIT IV-4

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION AMDAHL

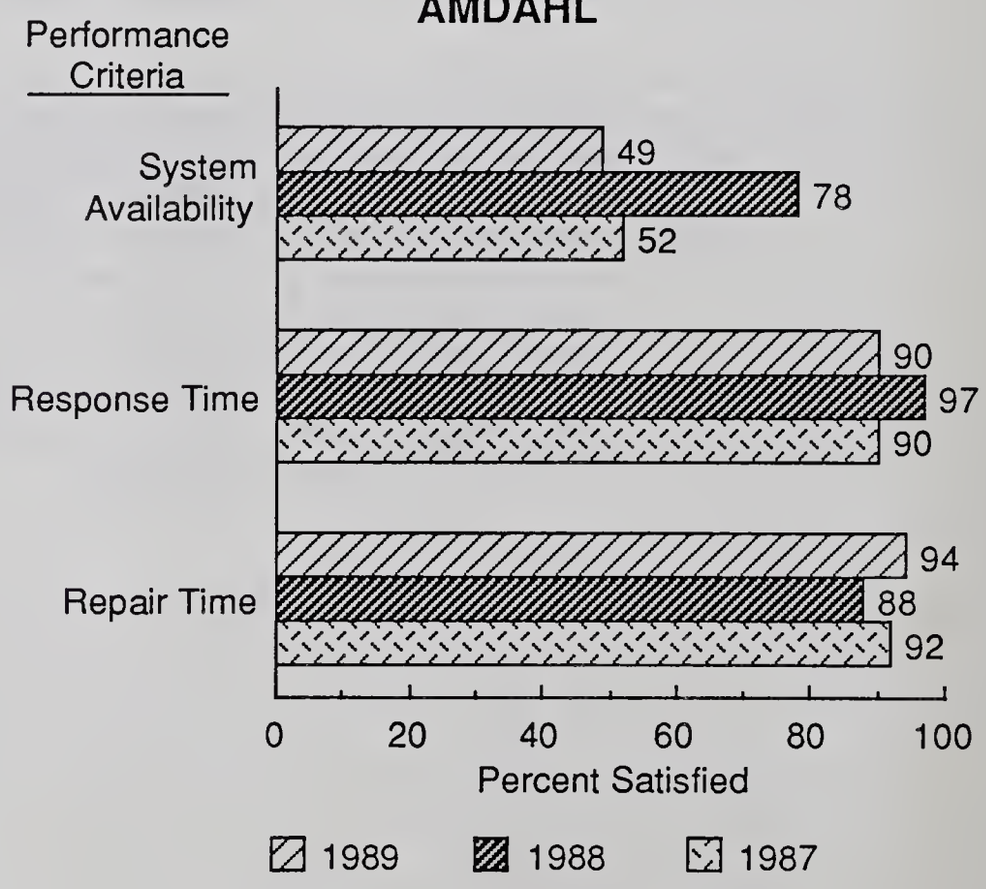

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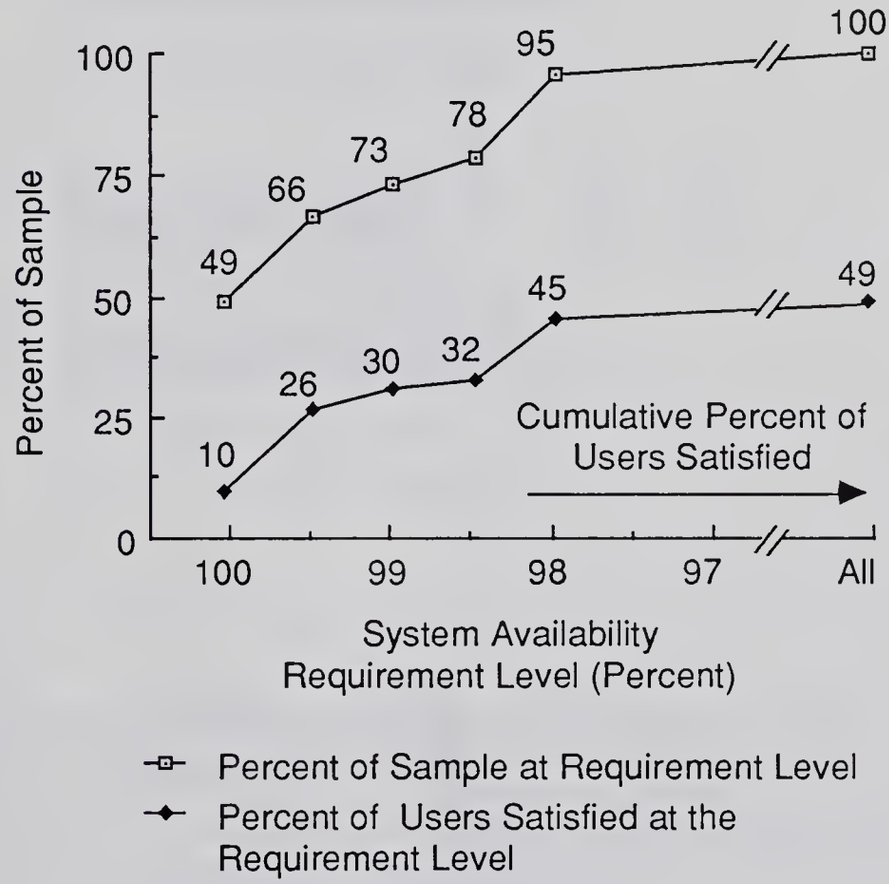
Exhibit IV-5 visually reinforces the high system availability requirements of Amdahl users. Not only do virtually one half of Amdahl users expect 100% availability, but almost all of the Amdahl users require at least 98% system availability.

EXHIBIT IV-5



Amdahl users also report high requirement levels for many areas of hardware maintenance. Exhibit IV-6 shows that Amdahl users recognize the impact that spare parts availability, hardware engineer skill level, and hardware maintenance in general have on system availability. Fortunately, Amdahl excels in these areas, as shown in Exhibit IV-7. However, user satisfaction with spares availability declined slightly. Rising spare parts costs make this area a key concern.

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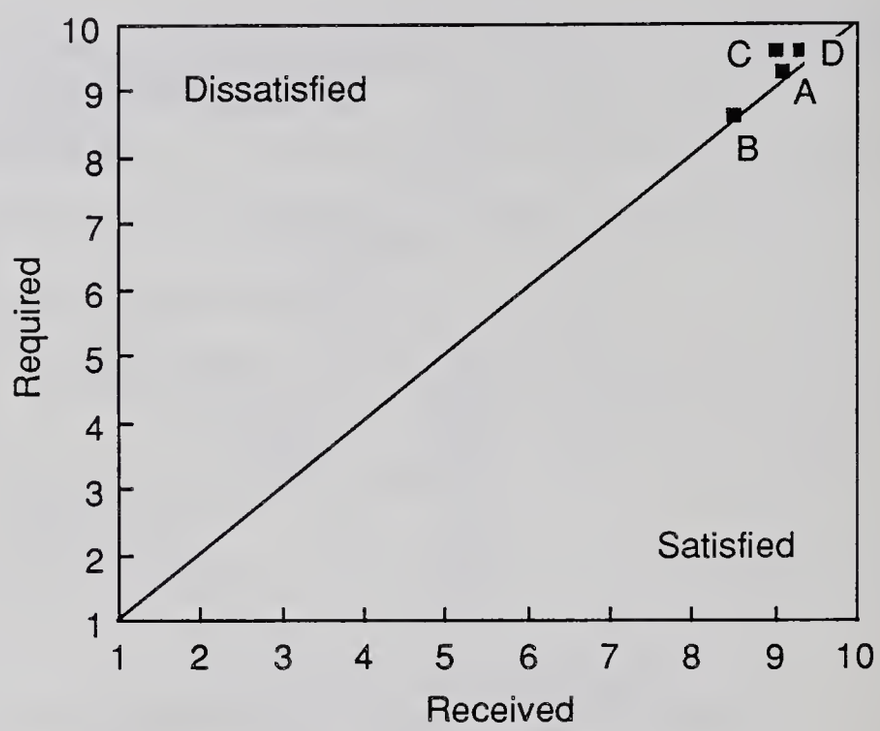
EXHIBIT IV-6

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED AMDAHL



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	9.3	0.1	9.1	0.1
B	HW Remote Support	8.6	0.4	8.5	0.3
C	Spare Parts	9.6	0.1	9.0	0.2
D	HW Maintenance Overall	9.6	0.1	9.3	0.1

Scale 1=Low, 10=High
SE=Standard Error

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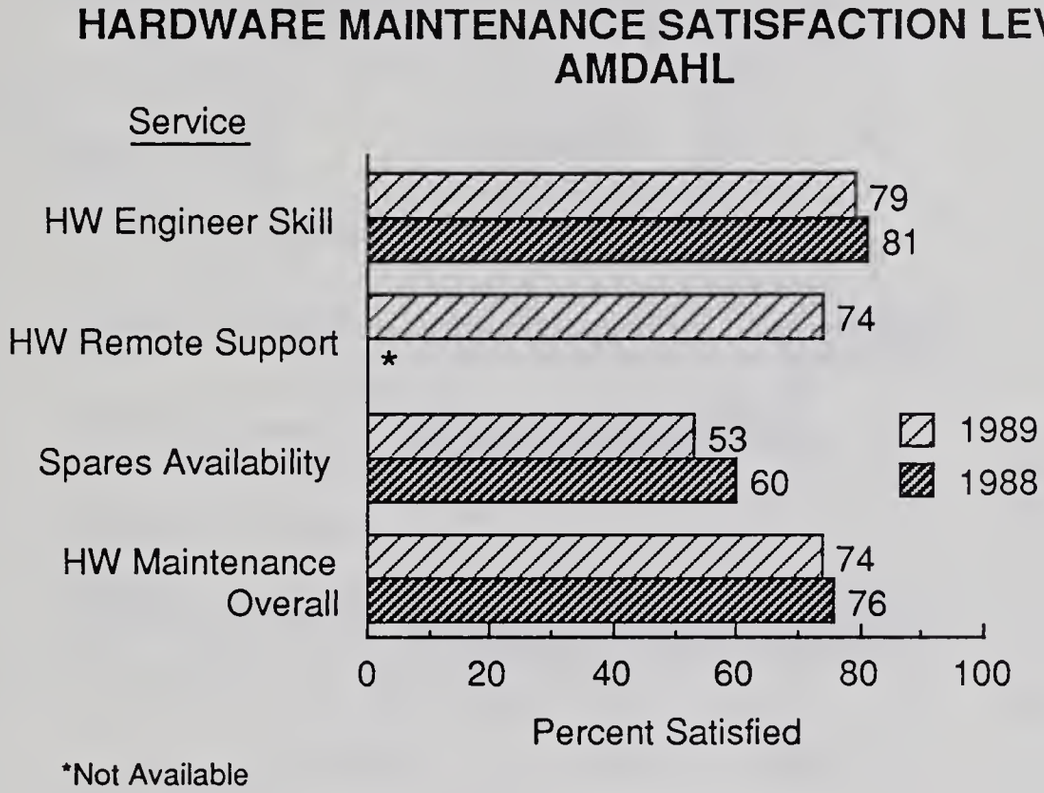
EXHIBIT IV-7



*Not Available

Software support is an area where one normally does not consider Amdahl, which, as a plug-compatible vendor, specializes in hardware (users license their software from IBM or other software vendors). Still, Amdahl provides software support services to users out of their telephone support centers, and just over one-third of the Amdahl sample reported experience with software support from Amdahl.

Exhibit IV-8 indicates that although user experience with Amdahl software support may have been somewhat limited, Amdahl software support performance essentially met user requirements, and, as shown in Exhibit IV-9, satisfied most users.

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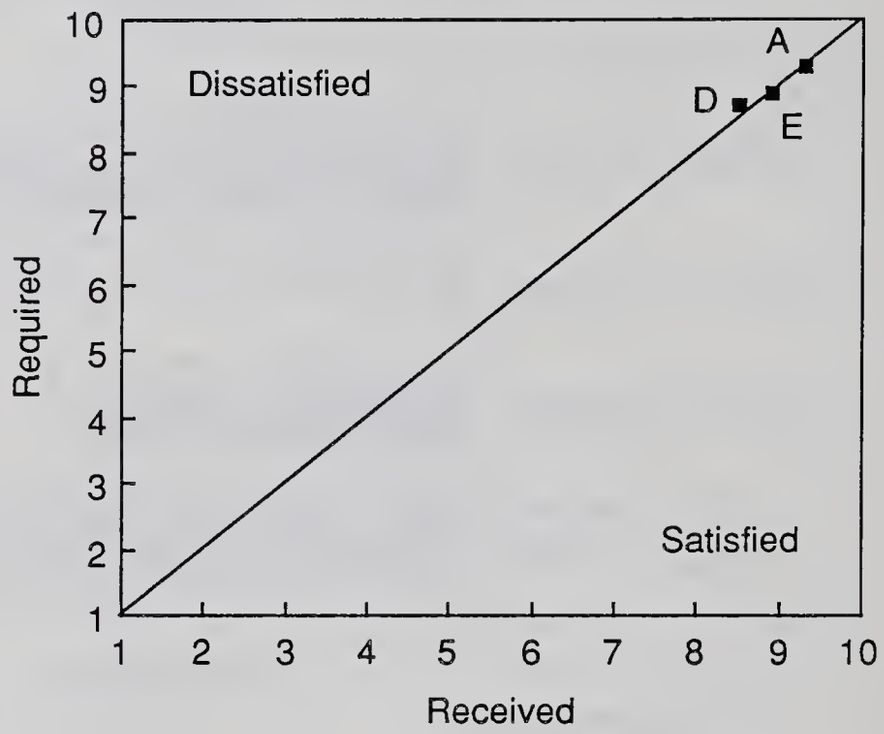
EXHIBIT IV-8

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED AMDAHL



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	9.3	0.3	9.3	0.2
B	SW Remote Support	**	**	**	**
C	SW Documentation	**	**	**	**
D	Operational Training	8.7	0.5	8.5	0.4
E	SW Support Overall	8.9	0.3	8.9	0.3

**Insufficient Response
Scale 1=Low, 10=High

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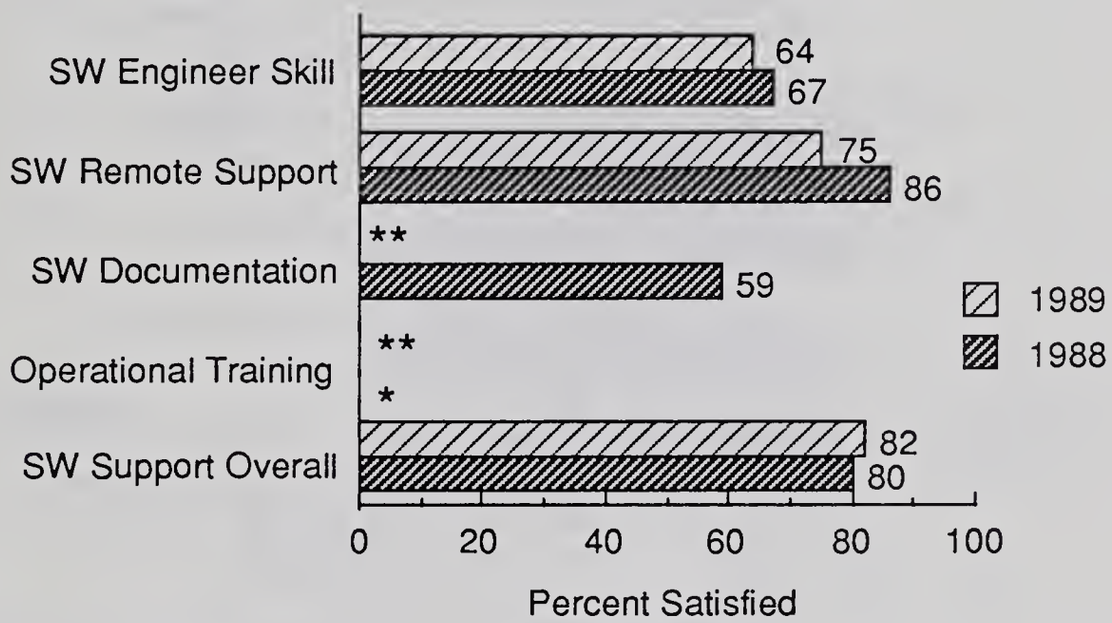
EXHIBIT IV-9



*Not Available
**Insufficient Response

Amdahl also excels in many of the ancillary services that are growing in importance to most large-system users. According to Exhibit IV-10, Amdahl users place particular importance on preinstallation planning services (not surprising due to the value of the system) and installation and deinstallation services. Exhibit IV-11 indicates that Amdahl was extremely successful at satisfying its users in the area of preinstallation planning, satisfying 88% of the 1988 sample, up from 69% last year. Amdahl was less successful in the area of installations and deinstallations—user satisfaction dropped from 74% in 1988 to just 56% in 1989.

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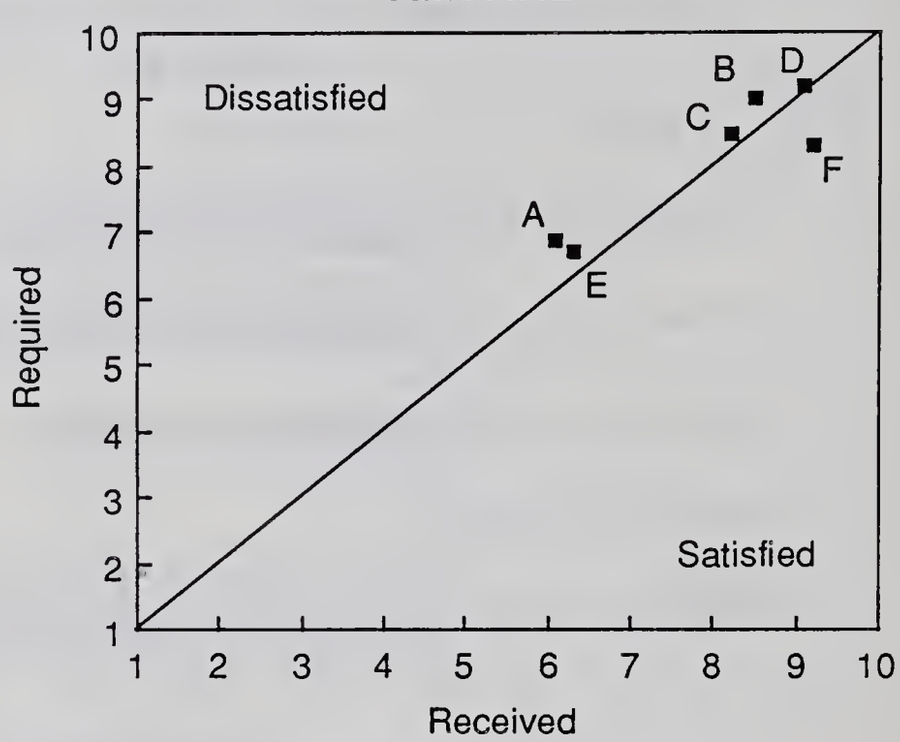
EXHIBIT IV-10

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED AMDAHL



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.9	0.6	6.1	0.6
B	Preinstallation Planning	9.0	0.2	8.5	0.3
C	Consulting	8.3	0.4	9.2	0.3
D	Installation/ Deinstallation	9.2	0.2	9.1	0.2
E	Network Designs/ Planning	6.7	0.7	6.3	0.7
F	Ancillary Services Overall	8.5	0.3	8.2	0.3

Scale 1=Low, 10=High
SE=Standard Error

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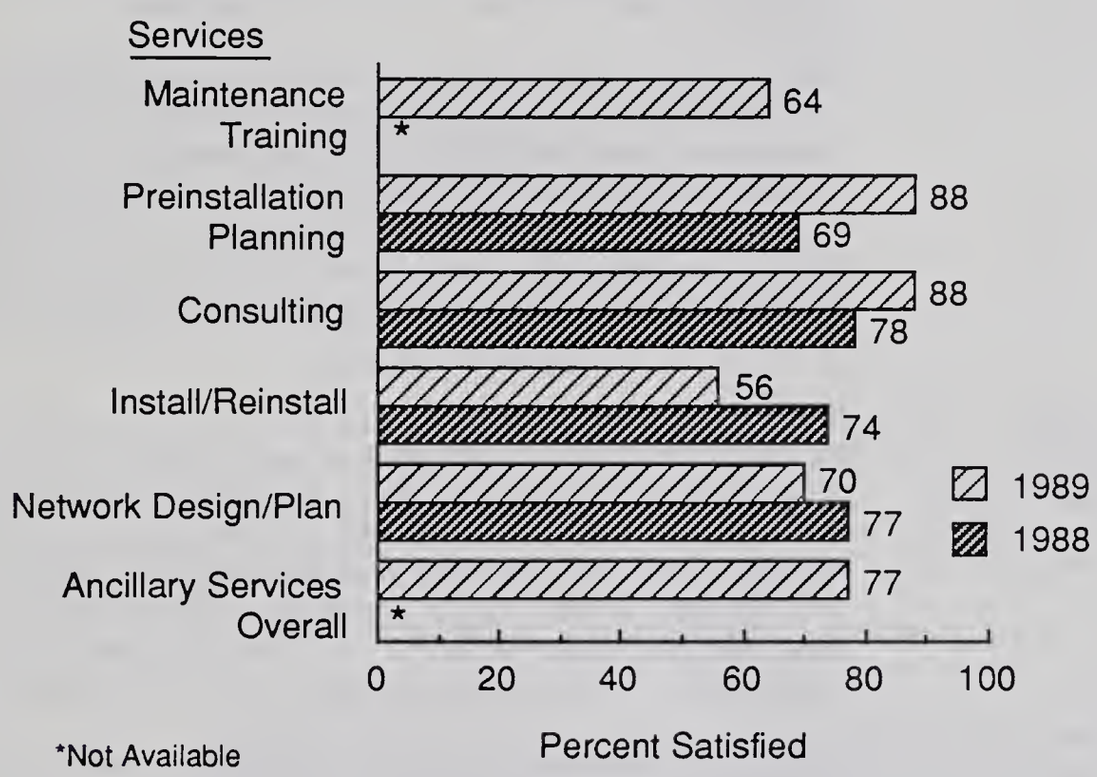
EXHIBIT IV-11



Few third-party maintenance organizations have targeted Amdahl systems. When this year's sample was asked which TPMs had contacted them in the past twelve months, only 18 users responded. Only two TPMs were mentioned more than once: Sorbus, with 8 mentions; and Control Data Corporation, with three mentions. A wide range of reasons for turning the TPM down were given, but most often users reported they were satisfied with Amdahl (4 mentions), the price wasn't low enough (2 mentions), or company policy prevented them from switching (also 2 mentions). Amdahl user satisfaction with Amdahl service is sufficiently high that 58% of the sample reported that they would not switch to a TPM at any discount, and 17% more stated that they would require at least a 50% discount to switch.

Amdahl users were asked which support services they would like Amdahl to add to service offerings. The most interesting response came from three separate users who desired multivendor service from Amdahl. Indeed, only 17% of the Amdahl sample reported that they received service from Amdahl on other vendors' peripherals, and even fewer users

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(8% of the sample) reported that they received service from Amdahl on other vendors' CPUs or network products (Amdahl does not pursue service of other vendors' products, although Amdahl reports it will support all products at a user site). This suggests an area of opportunity for Amdahl, since its users are satisfied enough with service to want Amdahl to take over the service of other products.

In summary, Amdahl's strengths include system reliability, response and repair time, hardware engineer skill level, hardware maintenance overall, software support overall, preinstallation planning, and consulting. Areas needing attention include spares availability, installation services (although these first two areas still satisfy the majority of Amdahl users, satisfaction levels have dropped from 1988), and user satisfaction with system availability (which dropped from 78% satisfied in 1988 to 49% in 1989).

B

Control Data Corporation (CDC)

In 1988, INPUT surveyed forty-five users of CDC Cyber systems, broken into the following products: thirty-four Cyber 180s and eleven Cyber 170s. The CDC sample can be broken down into the following industry categories: twenty-four educational users, eight services, four process manufacturers, and two each from discrete manufacturing, utilities, and other industry-specific. The remaining three respondents were from insurance, state and local government, and transportation.

Exhibit IV-12 presents the typical contractual service coverage received by CDC Cyber users. Note that the CDC sample predominantly receives prime-shift service (Monday through Friday, nine hours per day), although third-shift coverage is more pronounced this year versus the 1988 sample. This increase in third-shift coverage might be explained by the predominance of educational users in the CDC sample (comprising over 53% of the sample). The fact that these users have lower system availability requirements than do other users (shown later in this analysis) suggests that around-the-clock service coverage is not a high requirement for CDC users.

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EXHIBIT IV-12

CONTRACT COVERAGE
CDC

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	67	87
Monday - Saturday	4	3
Monday - Sunday	29	10
Hours Covered		
1 - 9 Hours	58	59
10 - 16	28	31
16 - 24	14	10

The CDC Cyber product reliability was substantially improved over 1988, as shown in Exhibit IV-13. This improvement in system reliability is a continuation of a trend reported in last year's analysis, with system interruptions dropping from 2.3 per month in 1987, to 1.8 per month in 1988, to the current average of 1.0 per month.

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EXHIBIT IV-13

SYSTEM INTERRUPTION ANALYSIS
CDC
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	1.0	0.2	1.8	0.4
Hardware-Caused	66	5.5	62	6.2
System-Software-Caused	11	3.1	16	4.7
Application-Software-Caused	7	1.8	2	1.0
Other-Caused	16	4.4	20	5.2

SE=Standard Error

As shown in Exhibit IV-14, CDC also managed to meet users' rather conservative system availability requirement of 96.7% (required) with a reported actual of 97.4%. CDC user expectations for system availability have dropped significantly in the last three years (the 1987 system availability requirement was 98.4%; the 1988 requirement level was 97.8%), whereas CDC's system availability levels have remained constant. As a point of reference, the overall sample of large-system users required a full percentage point higher system availability (97.8%), as shown earlier in Exhibit III-4.

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EXHIBIT IV-14

SYSTEM AVAILABILITY PERFORMANCE ANALYSIS CDC

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	96.7	0.8	97.4	0.7
Response Time (Hrs)	3.5	0.2	2.4	0.7
Repair Time (Hrs)	3.8	0.9	4.1	0.9

SE=Standard Error

The response and repair time requirements shown in Exhibit IV-14 and reported by the CDC users were also quite conservative when compared to the overall large-system sample. CDC easily betters its users' requirement for service response time and essentially meets users' repair time requirements. Exhibit IV-15 demonstrates that CDC user satisfaction with system availability has increased dramatically (from 53% in 1988 to 80% satisfied in 1989), while response and repair time satisfaction continues to stay quite high.

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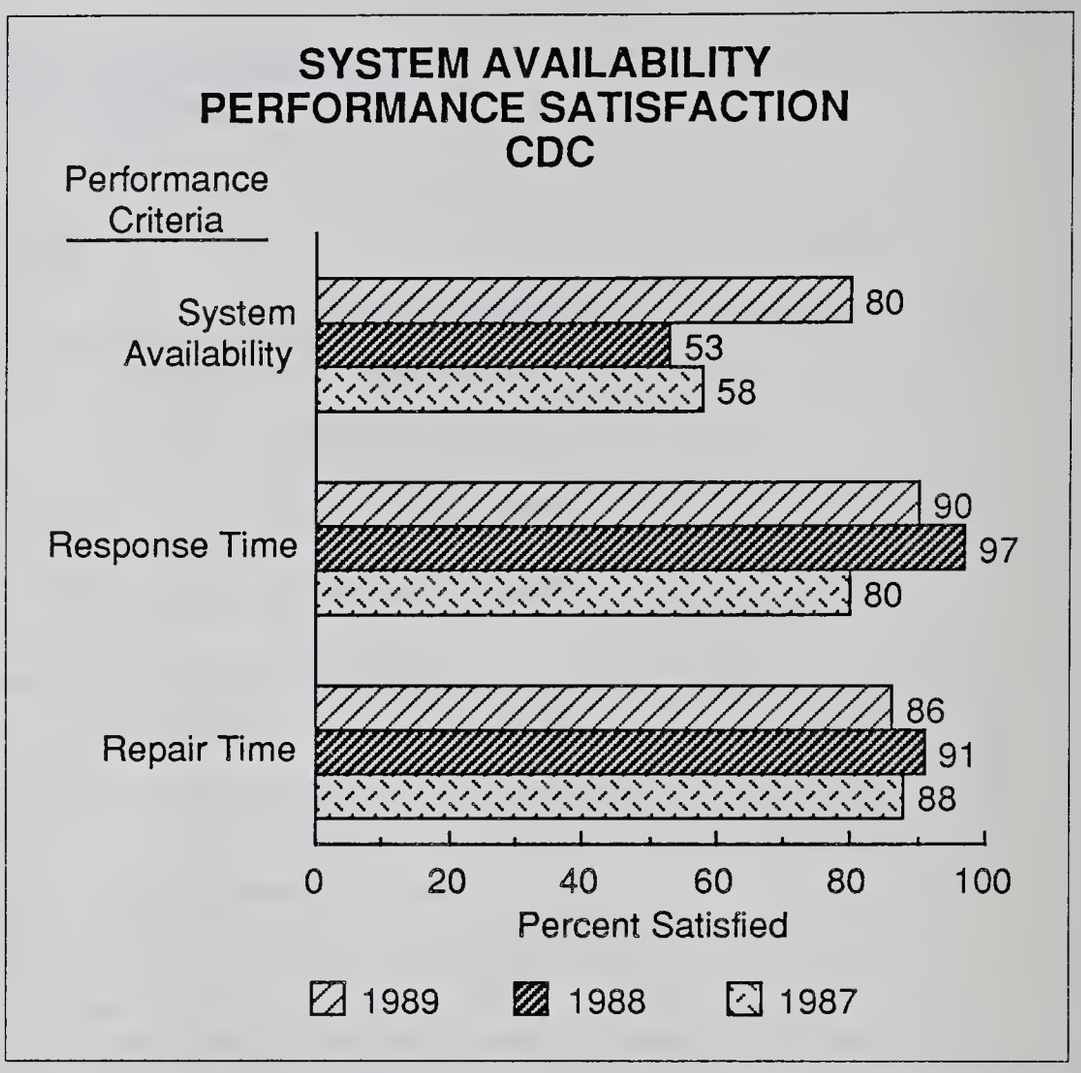
EXHIBIT IV-15



Again, it should be pointed out that CDC user expectations are on the low side regarding system availability. Exhibit IV-16 indicates that over half of the CDC users require system availability below 98.5%. The overall large system sample, on the other hand, reports much higher requirements, with 65% of the sample requiring above 98.5% system availability.

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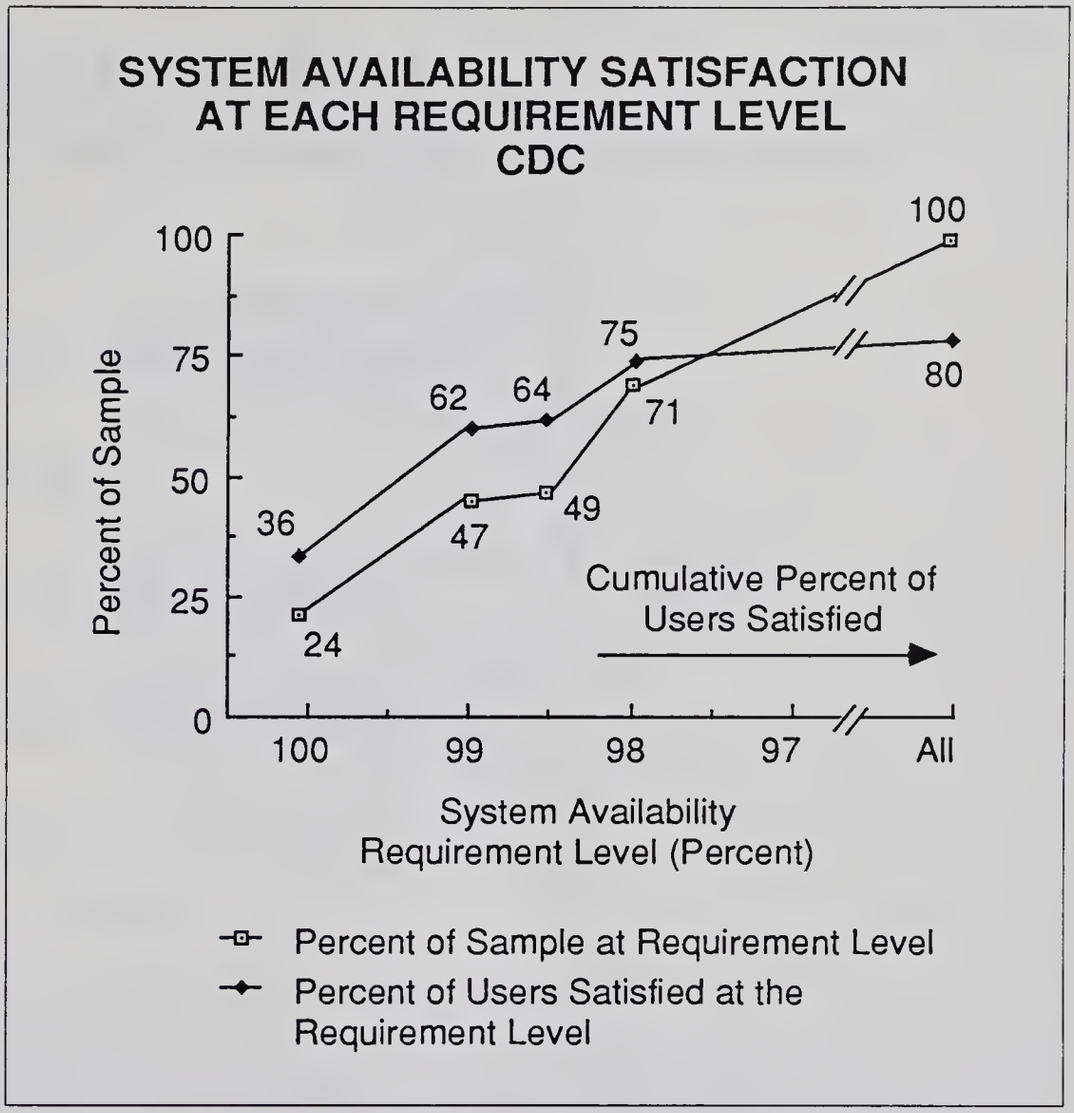
EXHIBIT IV-16



The CDC users also reported lower requirements for most areas of service and support. Exhibit IV-17 indicates that CDC users rated their requirement for all hardware maintenance areas below the 9.0 mark (where the overall sample rated HW engineer skill level and hardware maintenance overall at 9.0 and 9.1 respectively). CDC average performance falls below their users' requirement in all hardware support areas except hardware remote support. CDC user satisfaction with all areas of hardware maintenance rose appreciably however, in 1989 as displayed in Exhibit IV-18.

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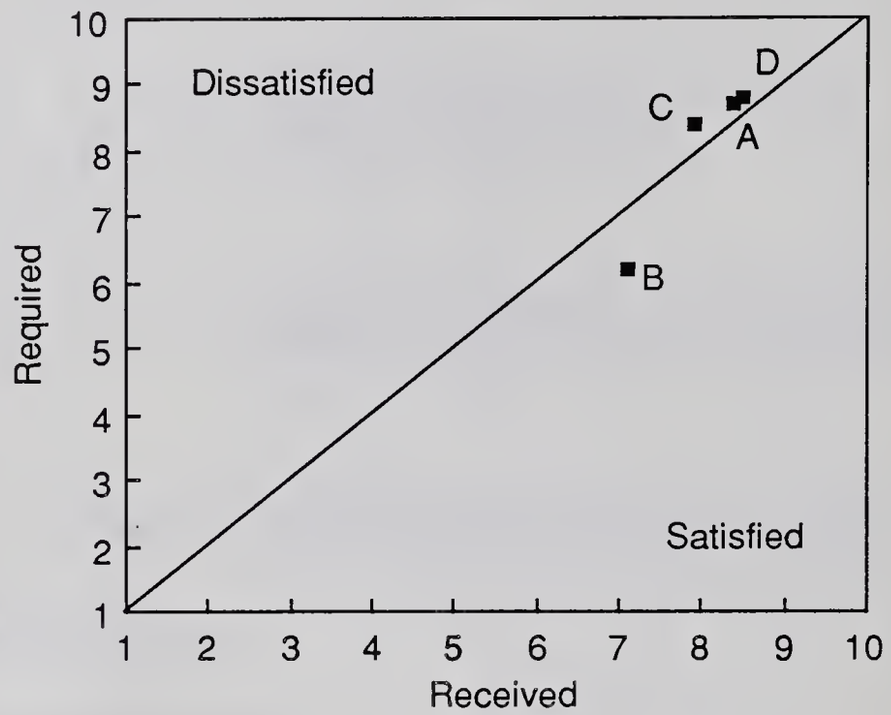
EXHIBIT IV-17

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED CDC



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	8.7	0.2	8.4	0.2
B	HW Remote Support	6.2	0.5	7.1	0.3
C	Spare Parts	8.4	0.2	7.9	0.2
D	HW Maintenance Overall	8.8	0.2	8.5	0.2

Scale 1=Low, 10=High
SE=Standard Error

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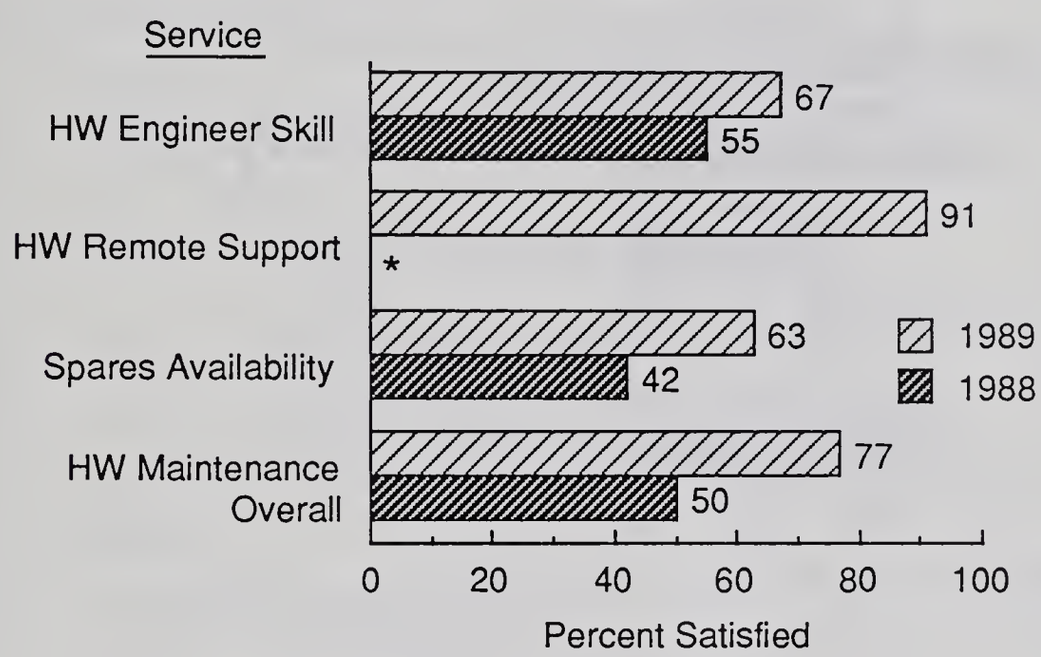
EXHIBIT IV-18



*Not Available

CDC's success at meeting its users' needs for software support is shown in Exhibits IV-19 and IV-20. CDC users expressed greatest disappointment with software engineer skill level (only 38% satisfied, down from 71% in 1988) and software documentation (only 26% satisfied).

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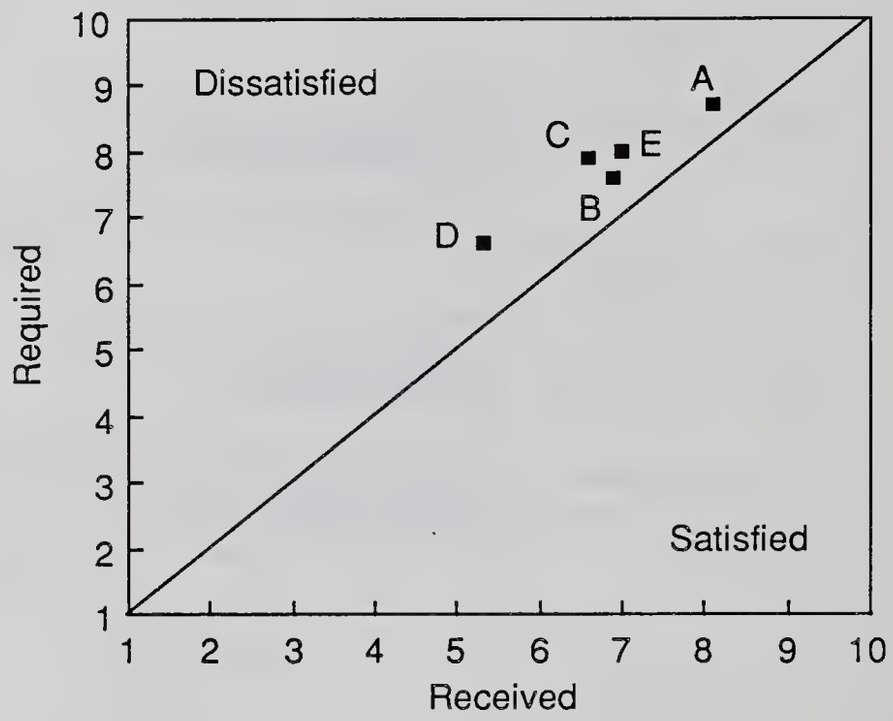
EXHIBIT IV-19

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED CDC



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	8.7	0.4	8.1	0.3
B	SW Remote Support	7.6	0.4	6.9	0.4
C	SW Documentation	7.9	0.3	6.6	0.3
D	Operational Training	6.6	0.8	5.3	0.8
E	SW Support Overall	8.0	0.3	7.0	0.3

Scale 1=Low, 10=High
SE=Standard Error

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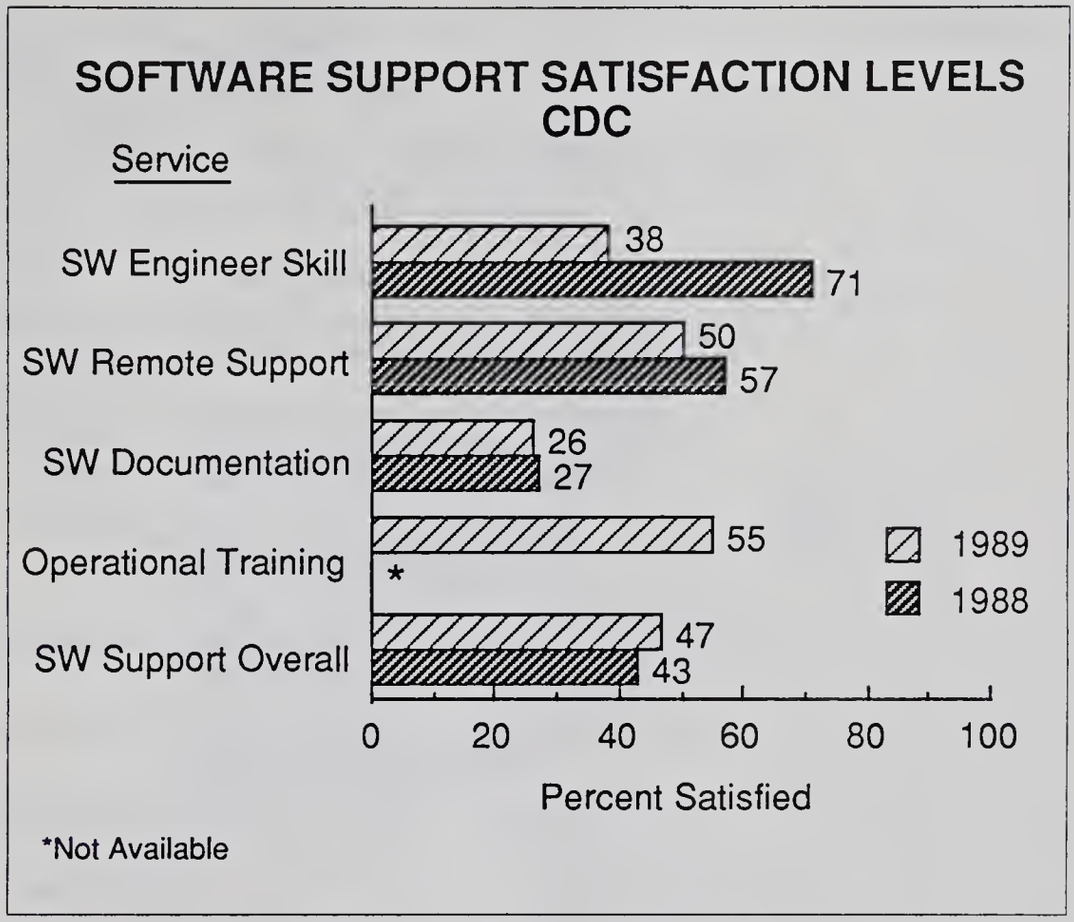
EXHIBIT IV-20



CDC was much more successful at meeting the needs of its users for such ancillary services as preinstallation planning and installation services, as shown in Exhibit IV-21. Exhibit IV-22 shows that CDC satisfies at least three-fourths of its users in all but one area tested in 1989.

As mentioned earlier, CDC managed to satisfy the majority of its users' needs in the area of spares parts availability, improving dramatically over 1988. Still, eight users reported spares availability as their primary service concern, reflecting users' recognition of the importance of spares on system availability, particularly on older equipment (Cyber 180s have been in use since 1984).

In summary, CDC's service strengths include system availability, response time, hardware remote support, and installation services. The area most needing improvement is software support (particularly software engineer skill level and documentation).

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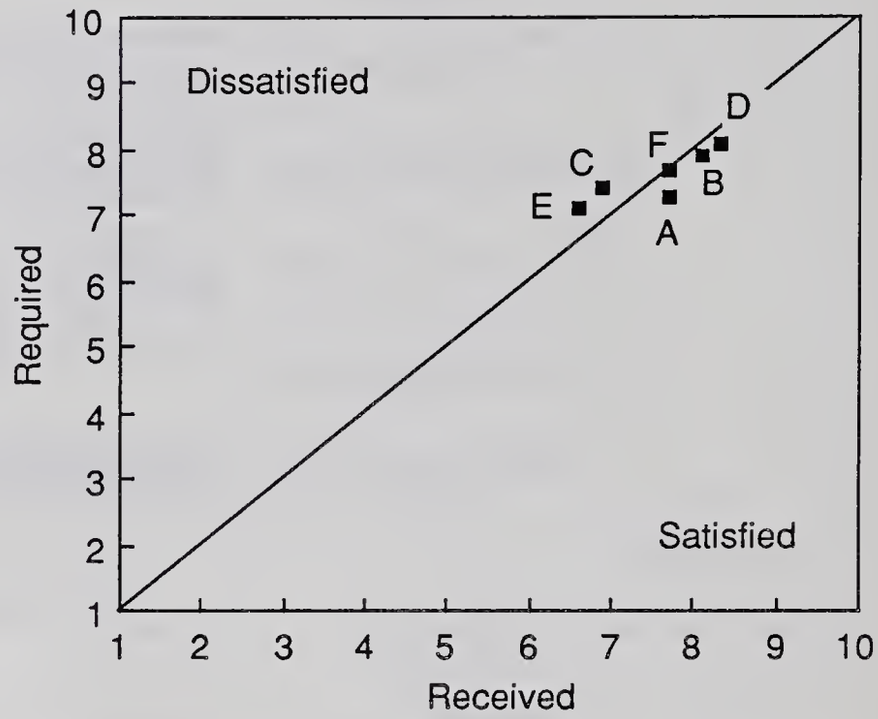
EXHIBIT IV-21

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED CDC



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	7.3	0.9	7.7	0.7
B	Preinstallation Planning	7.9	0.3	8.1	0.3
C	Consulting	7.4	0.5	6.9	0.6
D	Installation/ Deinstallation	8.1	0.3	8.3	0.3
E	Network Designs/ Planning	7.1	0.6	6.6	0.5
F	Ancillary Services Overall	7.7	0.3	7.7	0.3

Scale 1=Low, 10=High
SE=Standard Error

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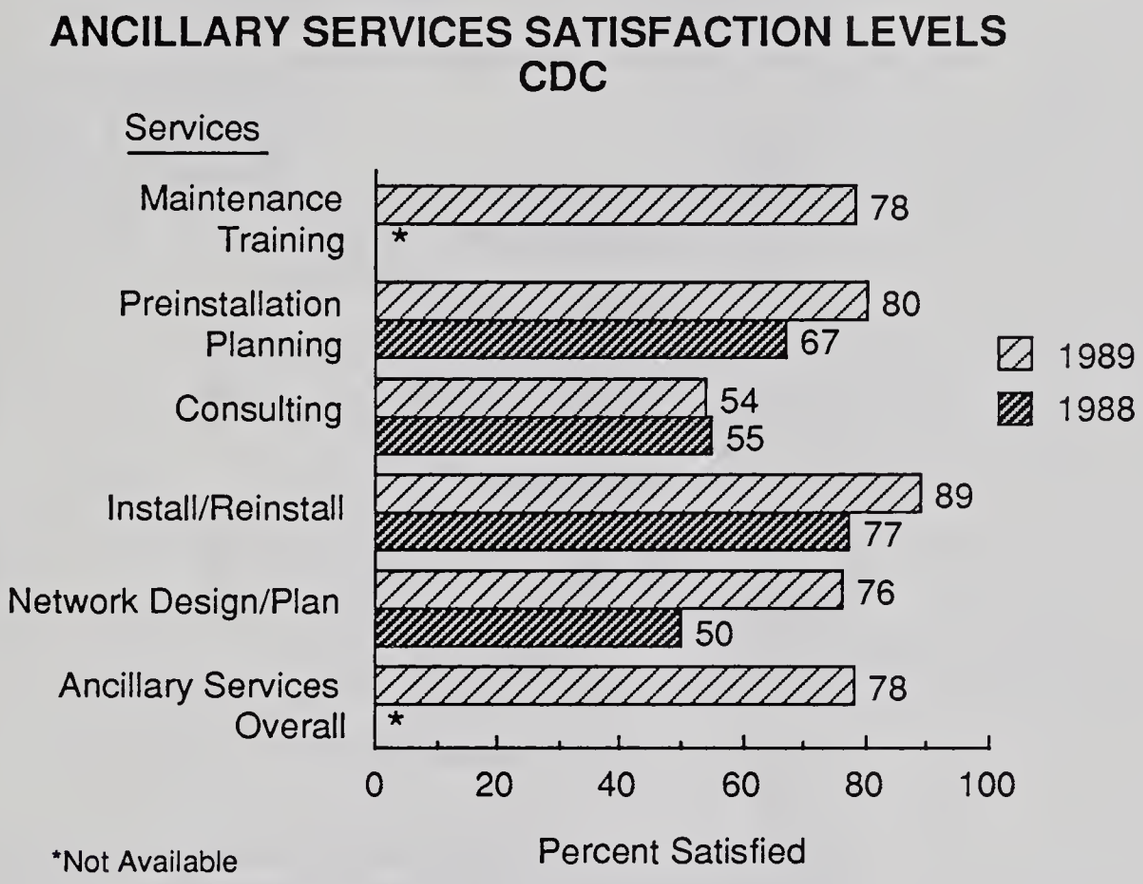
EXHIBIT IV-22



C

Bull H. N. Information Systems, Inc.

In 1989, INPUT surveyed forty-five users of Bull H. N. mainframe systems, including twenty-three DPS8/4Xs, eleven DPS8/7Xs, four DPS8/8Xs, three DPS8/5Xs, and four miscellaneous DPS8 systems. The user sample was composed of users from the following industries: education (16 users), process manufacturing (8 users), transportation (7 users), discrete manufacturing (6 users), federal government (6 users), and one each from retail and state & local government.

Exhibit IV-23 provides a look at the typical contract service coverage reported by Bull H. N. users. The majority of DPS8 users continue to contract for five-day and nine-hour (per day) coverage. As was the case with the CDC users, the predominance of education and federal government users tends to limit the use of extended service coverage.

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EXHIBIT IV-23

CONTRACT COVERAGE
BULL H. N.

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	76	77
Monday - Saturday	0	5
Monday - Sunday	24	18
Hours Covered		
1 - 9 Hours	72	58
10 - 16	16	15
16 - 24	12	27

Exhibit IV-24 indicates that although the average number of system interruptions reported by DPS8 users dropped from 1.3 per month to 1.0 per month, hardware reliability has changed: the percentage of hardware-related failures increased from 59% to 77%.

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EXHIBIT IV-24

SYSTEM INTERRUPTION ANALYSIS
BULL H. N.
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	1.0	0.3	1.3	0.2
Hardware-Caused	77	4.5	59	5.5
System-Software-Caused	16	3.3	13	3.2
Application-Software-Caused	2	1.1	6	1.8
Other-Caused	5	3.4	22	5.0

SE=Standard Error

As shown in Exhibit IV-25, Bull H. N. was able to beat its users' expressed mean requirement for system availability, with an actual mark of 98.5% versus a requirement of 98.0%. In addition, Bull H. N. exceeded the mean requirements for response and repair times (however, the standard error of the mean was quite high).

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EXHIBIT IV-25

SYSTEM AVAILABILITY PERFORMANCE ANALYSIS BULL H. N.

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	98.0	0.3	98.5	0.2
Response Time (Hrs)	1.9	0.1	1.4	0.1
Repair Time (Hrs)	3.1	0.4	2.7	0.5

SE=Standard Error

According to Exhibit IV-26, user satisfaction with system availability rose from 49% of the 1988 DPS sample satisfied to 73% in 1989. Furthermore, Bull H. N. satisfied nine out of ten users with regard to response and repair time.

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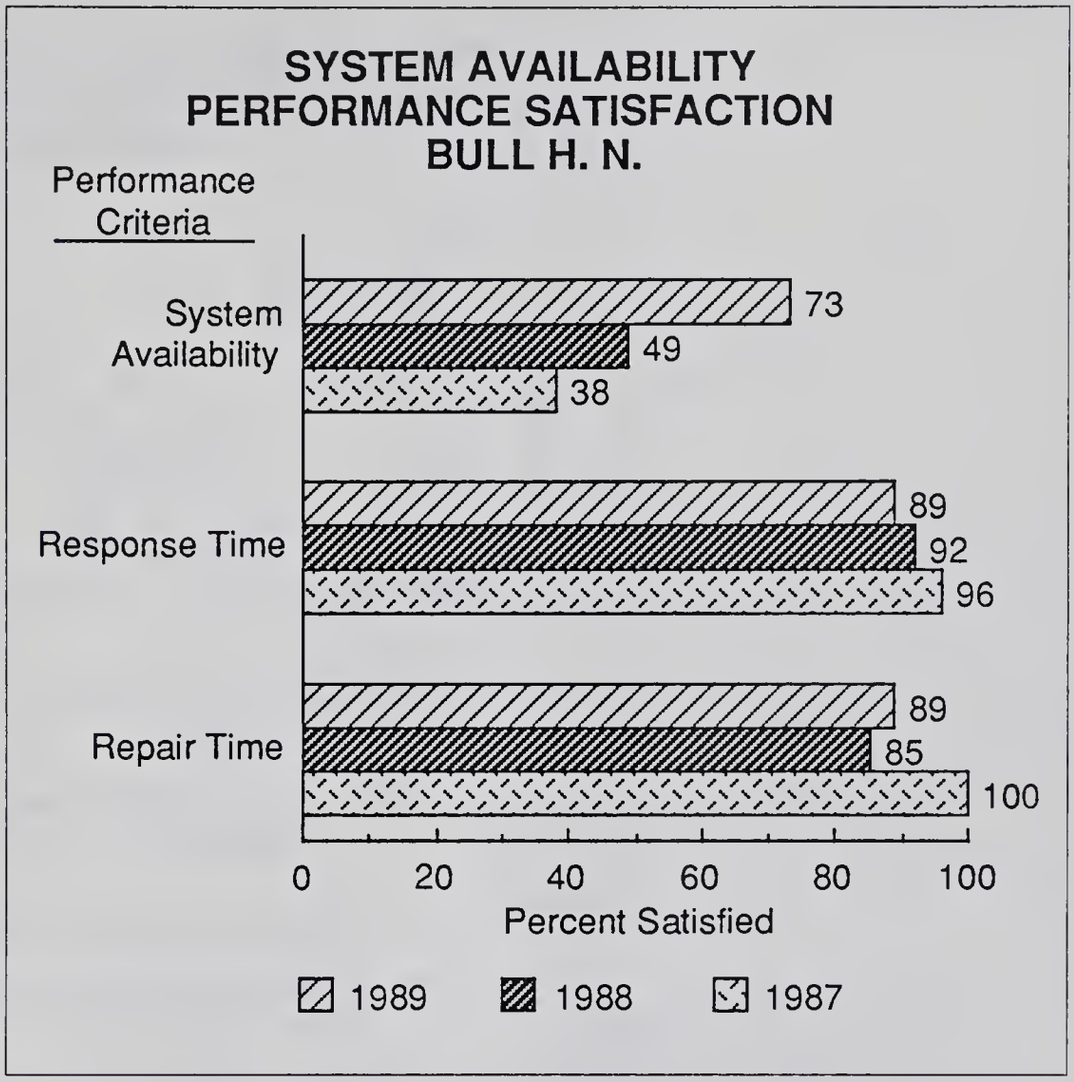
EXHIBIT IV-26



Of course, Bull H. N. enjoys the advantage of fairly conservative system availability requirements expressed by many of its users. Exhibit IV-27 demonstrates that only 66% of all DPS8 users report system availability requirements of 98% or higher, versus 80% of all large-system users surveyed (and 95% of the Amdahl users).

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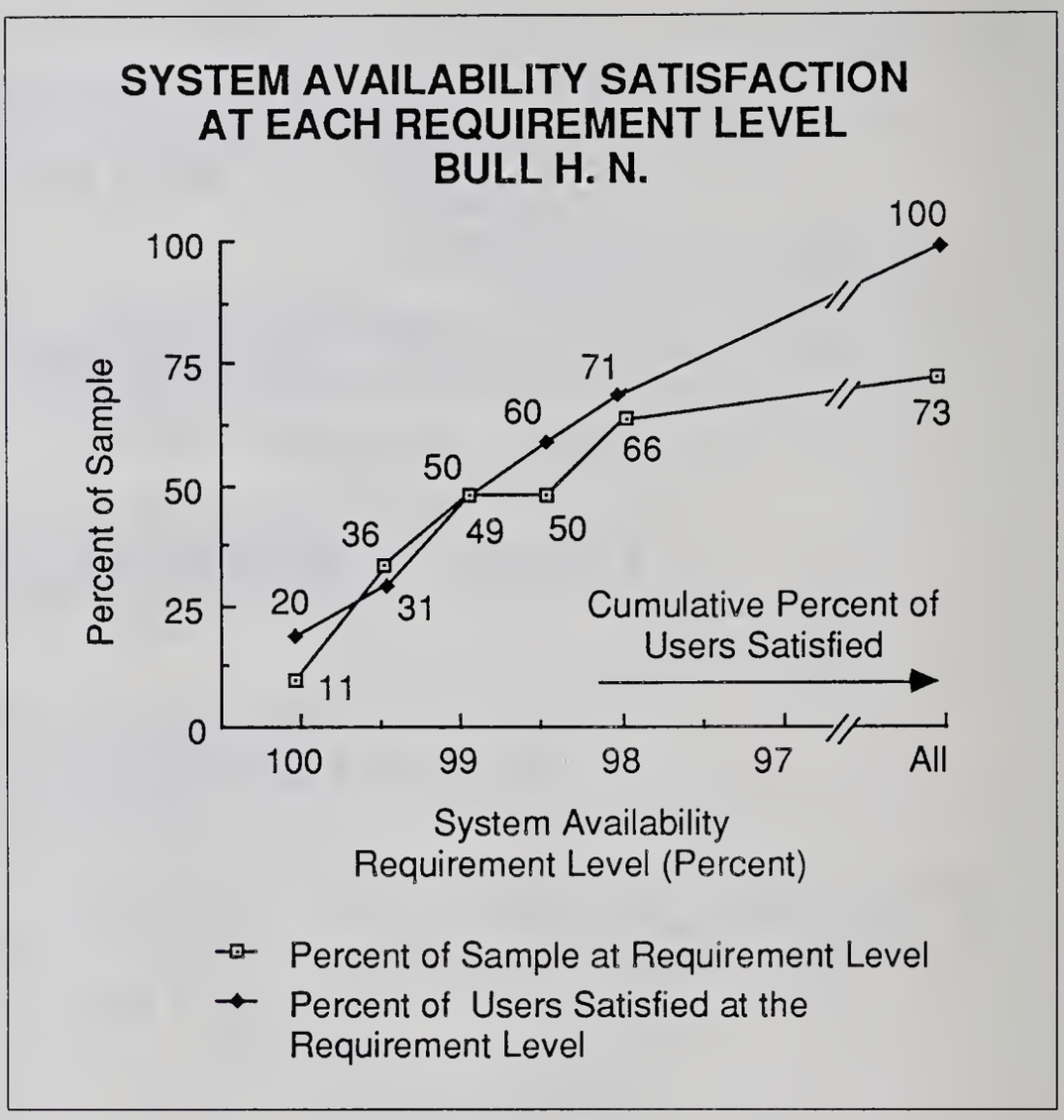
EXHIBIT IV-27



The DPS8 sample also reported comparatively low requirements for hardware maintenance services, as shown in Exhibit IV-28. The most pressing concern should be the lack of satisfaction with spare parts availability, where Bull H. N. performance falls farthest below users' requirements. This problem with spares is supported by Exhibit IV-29, which shows that Bull H. N. satisfies fewer than half of its users in this key area of support performance. Still, user satisfaction with hardware maintenance is up in all service areas, most dramatically in overall satisfaction with hardware maintenance (from 37% in 1988 to 78% in 1989).

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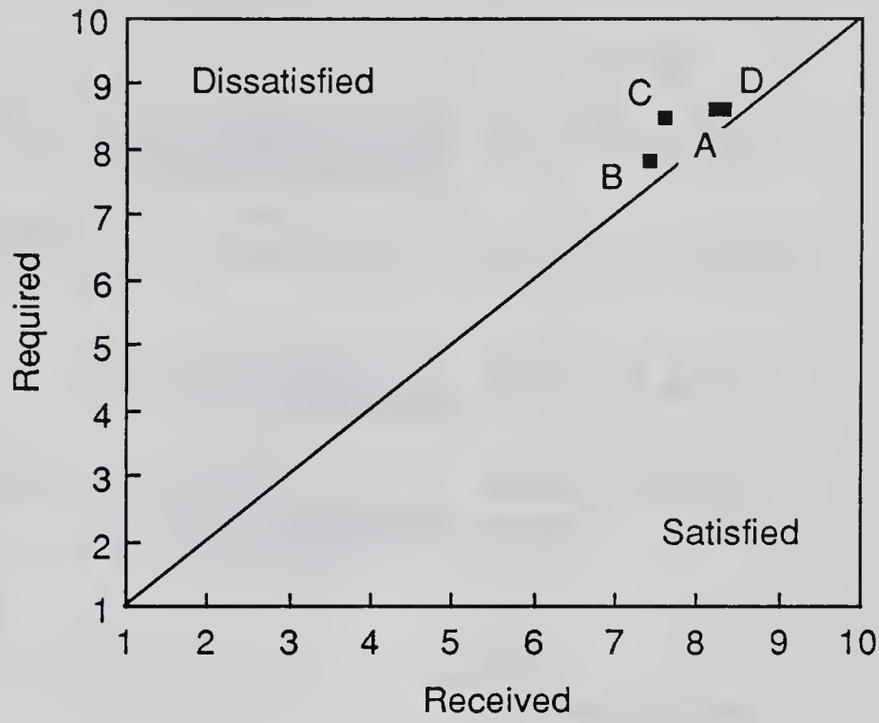
EXHIBIT IV-28

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED BULL H. N.



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	8.6	0.2	8.2	0.2
B	HW Remote Support	7.8	0.3	7.4	0.3
C	Spare Parts	8.5	0.2	7.6	0.2
D	HW Maintenance Overall	8.6	0.1	8.3	0.2

Scale 1=Low, 10=High
SE=Standard Error

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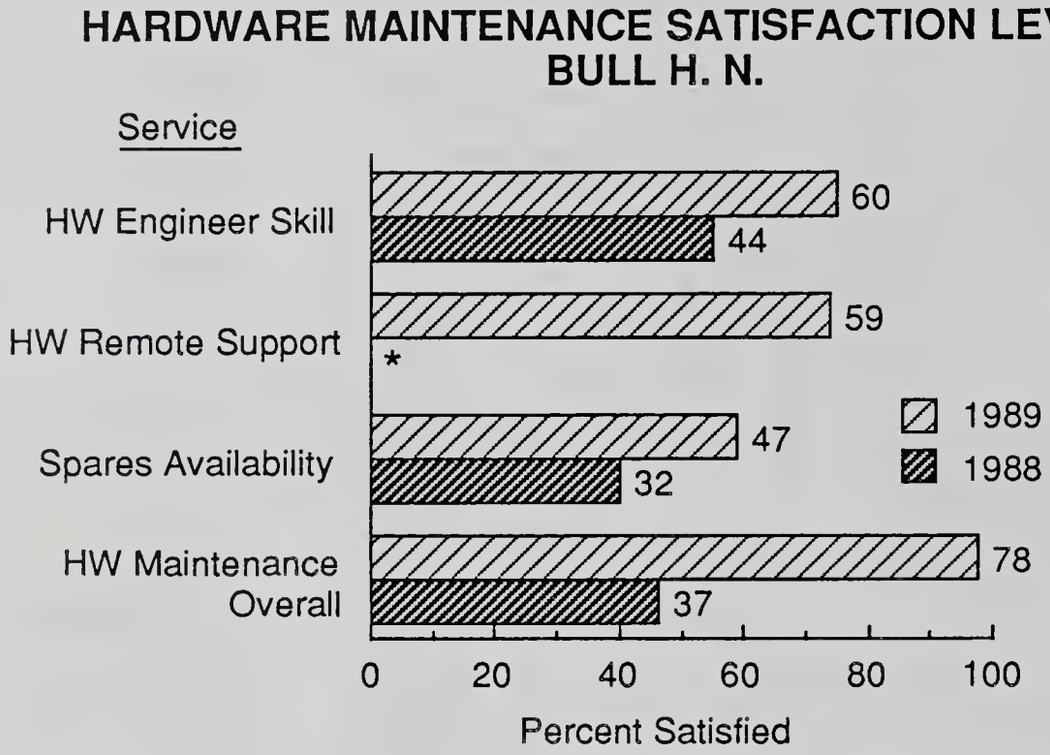
EXHIBIT IV-29



*Not Available

User satisfaction with software support also improved in 1989, as shown in Exhibits IV-30 and IV-31. The only area of concern is software documentation, which satisfied only 37% of the DPS8 sample.

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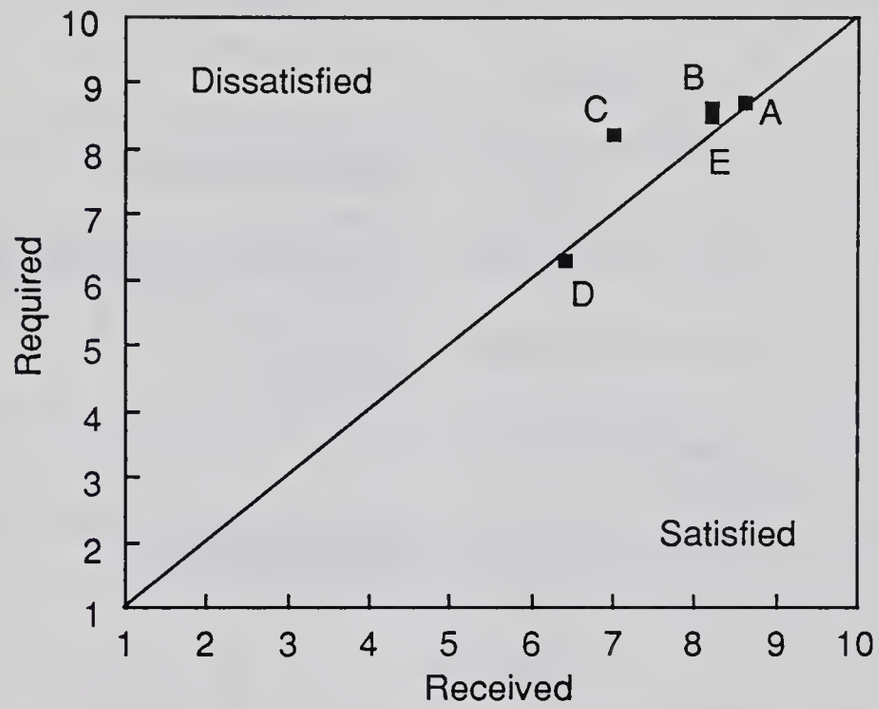
EXHIBIT IV-30

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED BULL H. N.



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	8.6	0.4	8.2	0.4
B	SW Remote Support	8.7	0.3	8.6	0.2
C	SW Documentation	8.2	0.3	7.0	0.3
D	Operational Training	6.3	0.5	6.4	0.5
E	SW Support Overall	8.5	0.2	8.2	0.2

Scale 1=Low, 10=High
SE=Standard Error

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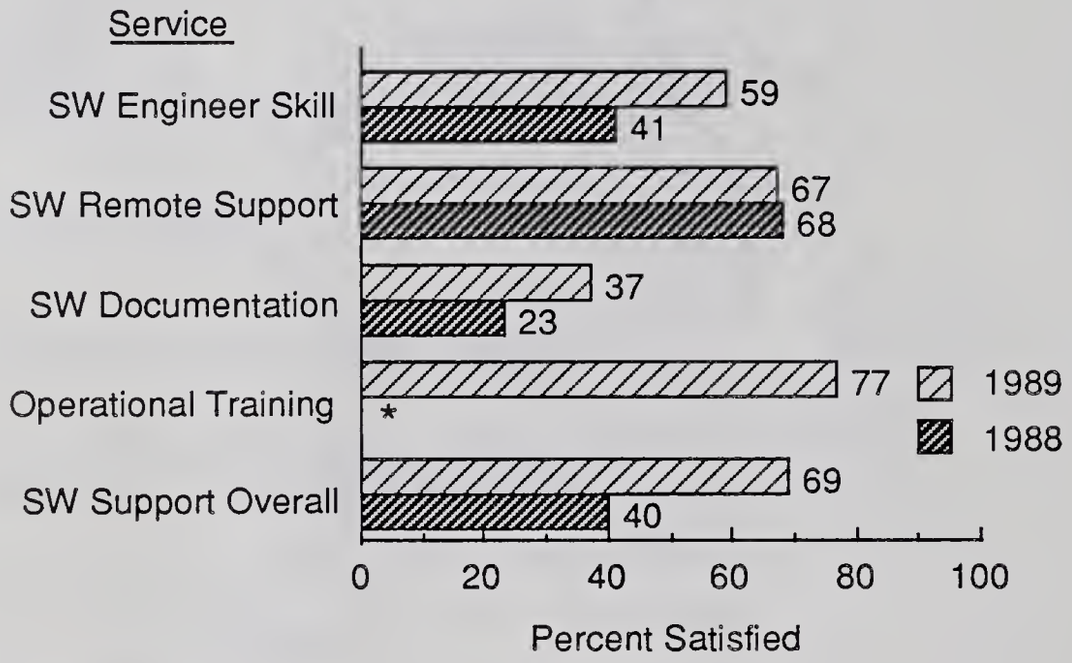
EXHIBIT IV-31



*Not Available

As shown in Exhibit IV-32 and IV-33 the DPS8 users reported widely varying levels of ancillary services received, resulting in low mean received ratings (and high standard errors of the means), but they still succeeded in satisfying three-quarters of their users in all areas measured. User satisfaction increased dramatically in the areas of consulting and network design and planning, two areas seen as critical in the future.

Nine of the DPS8 users were contacted by TPMs within the last twelve months. Sorbus contacted six of those users, but was turned down due to the distance from the user's site, or due to a previous bad experience with TPM.

When queried about their primary service concern, DPS8 users most often mentioned system availability (14 mentions) and spare parts availability (7 mentions). The reference to system availability is surprising, due to the sample's conservative system availability requirement level.

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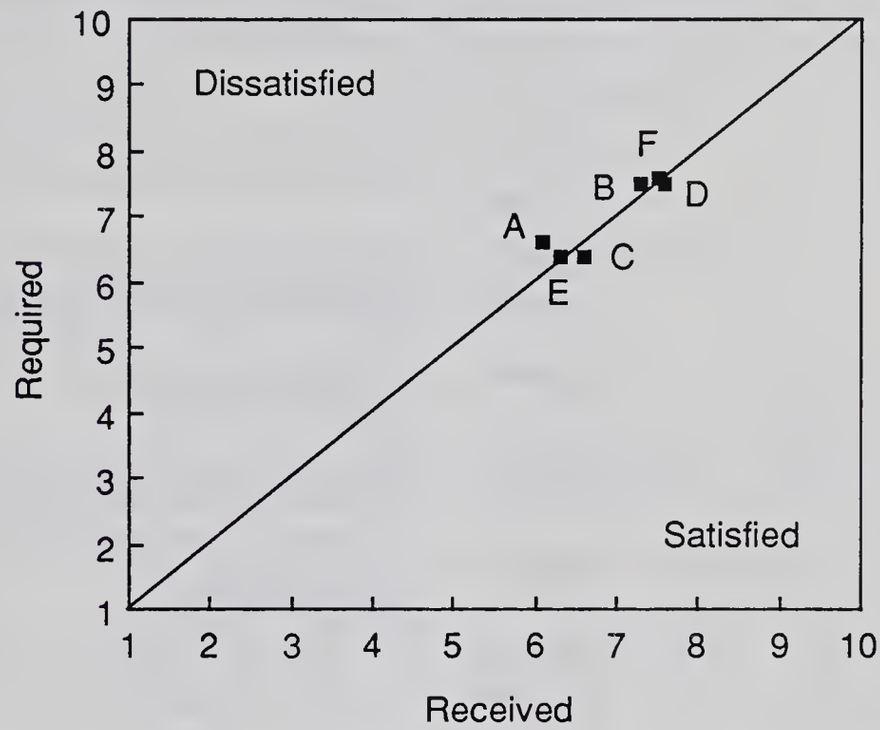
EXHIBIT IV-32

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED BULL H. N.



Key	Service	Required Mean	Required SE	Received Mean	Received SE
A	Maintenance Training	6.6	0.6	6.1	0.5
B	Preinstallation Planning	7.5	0.4	7.3	0.4
C	Consulting	6.4	0.5	6.6	0.5
D	Installation/ Deinstallation	7.5	0.4	7.6	0.5
E	Network Designs/ Planning	6.4	0.5	6.3	0.5
F	Ancillary Services Overall	7.6	0.3	7.5	0.3

Scale 1=Low, 10=High
SE=Standard Error

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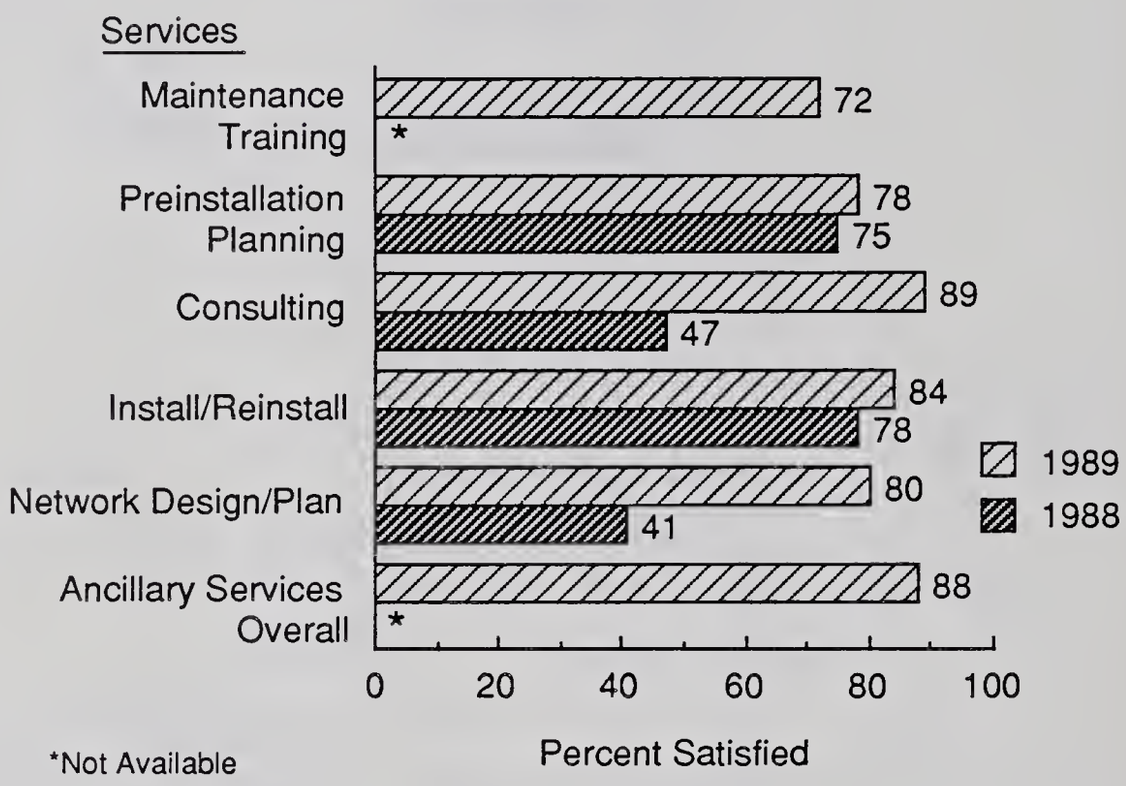
EXHIBIT IV-33



In summary, Bull H. N. service strengths include system availability, hardware maintenance overall, operational training, and all ancillary services (most impressively consulting services). Areas of concerns include spares availability and software documentation.

D

IBM 309X

In 1989, INPUT surveyed forty users of IBM 309X mainframe systems. The 309X sample can be broken down into the following model numbers: five 3090 Model 150s, four 3090 Model 180s, four 3090 Model 400s, three 3090 Model 200s, one 3090 Model 120, one 3090 Model 300, one 3090 Model 600, and twenty-one 3090s of unspecified models. The 309X user sample can also be broken down into the following industries: eight banking and finance users; eight process manufacturers; six services; three discrete manufacturers; three retail distributors; three insurance users; two educational users; two medical users; and one each from state and local government, transportation, utilities, wholesale, and other industry specific.

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Exhibit IV-34 presents a look at the typical service coverage reported by the IBM 309X users. In 1987, IBM extended all large- and small-system service coverage to 24-hour, seven-days-a-week (for no additional charge). The fact that the IBM large-system users surveyed, both in 1988 and in 1989 (and for both the 309X and 308X systems), report receiving anything less than around-the-clock coverage indicates that either some users are unaware that their coverage was expanded or some users may be negotiating discounted reduced coverage.

EXHIBIT IV-34

CONTRACT COVERAGE
IBM 309X

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	5	12
Monday - Saturday	0	0
Monday - Sunday	95	88
Hours Covered		
1 - 9 Hours	0	2
10 - 16	3	7
16 - 24	97	91

In 1988, 309X users reported that their systems incurred more system interruptions (2.8 per month) than the industry norm (1.6 per month). Exhibit IV-35 demonstrates that the 1989 309X sample reported vastly improved system reliability, averaging just 0.7 system interruptions per month. Last year's high number of system interruptions was attributed to software problems (most likely in the transfer of old applications into the new system). In 1989, the percentage of software problems declined significantly, while at the same time hardware reliability also appeared to improve (hardware failures averaged just under 1.1 per month in 1988, dropping to 0.4 per month in 1989).

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EXHIBIT IV-35

SYSTEM INTERRUPTION ANALYSIS
IBM 309X
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.7	0.2	2.8	0.5
Hardware-Caused	61	7.9	39	5.1
System-Software-Caused	23	6.1	36	4.4
Application-Software-Caused	4	2.3	17	3.8
Other-Caused	12	5.8	8	3.1

SE=Standard Error

The 309X users reported that the mean actual system availability that they received also exceeded their requirement level, as shown in Exhibit IV-36. At the same time, these users reported that IBM met their response time expectations but missed the mark regarding repair time objectives. Thus it is no surprise that an extremely high percentage of 309X users were satisfied with the system availability, response, and repair times they received, as shown in Exhibit IV-37. The most obvious change in user satisfaction can be seen in the area of system availability, where IBM satisfied 72% of the 309X users surveyed in 1989, up from 58% and 57% of the last two years' respondents. Also noteworthy is that IBM satisfied 100% of its 309X users with regard to response time for the second straight year.

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EXHIBIT IV-36

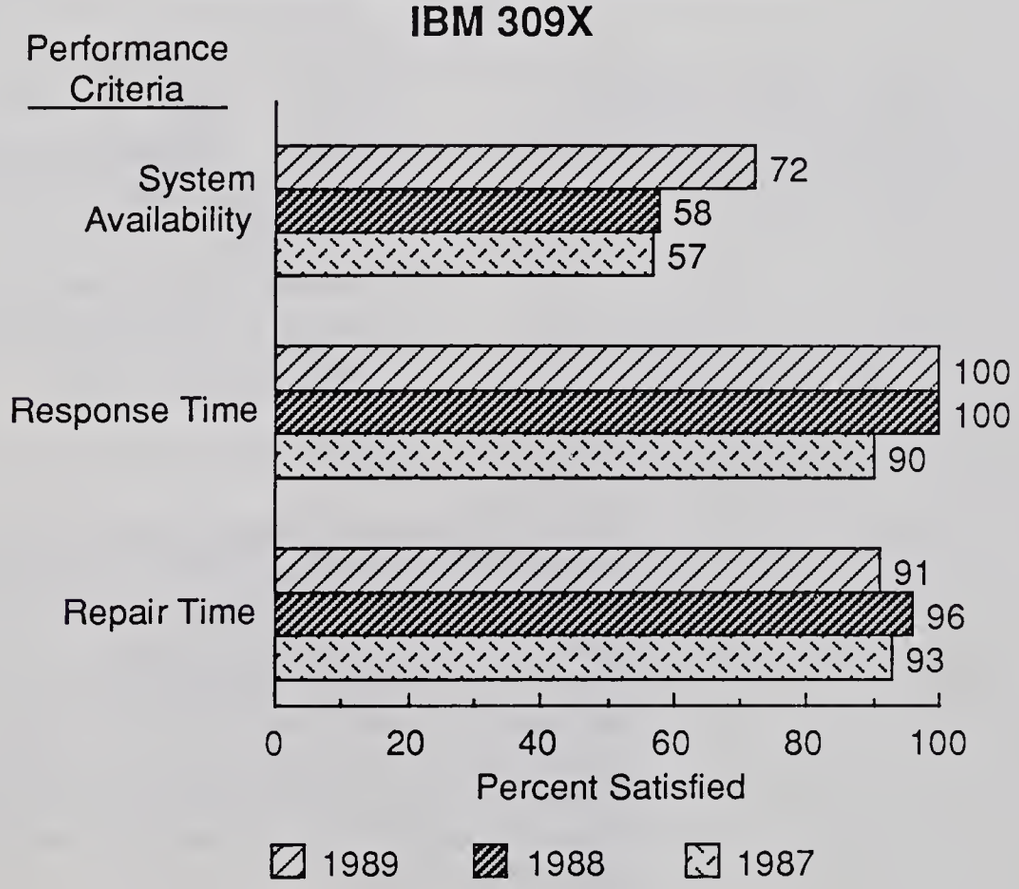
SYSTEM AVAILABILITY PERFORMANCE ANALYSIS IBM 309X

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	98.3	0.4	98.7	0.4
Response Time (Hrs)	1.3	0.1	1.0	0.1
Repair Time (Hrs)	2.0	0.2	2.3	0.6

SE=Standard Error

EXHIBIT IV-37

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION IBM 309X



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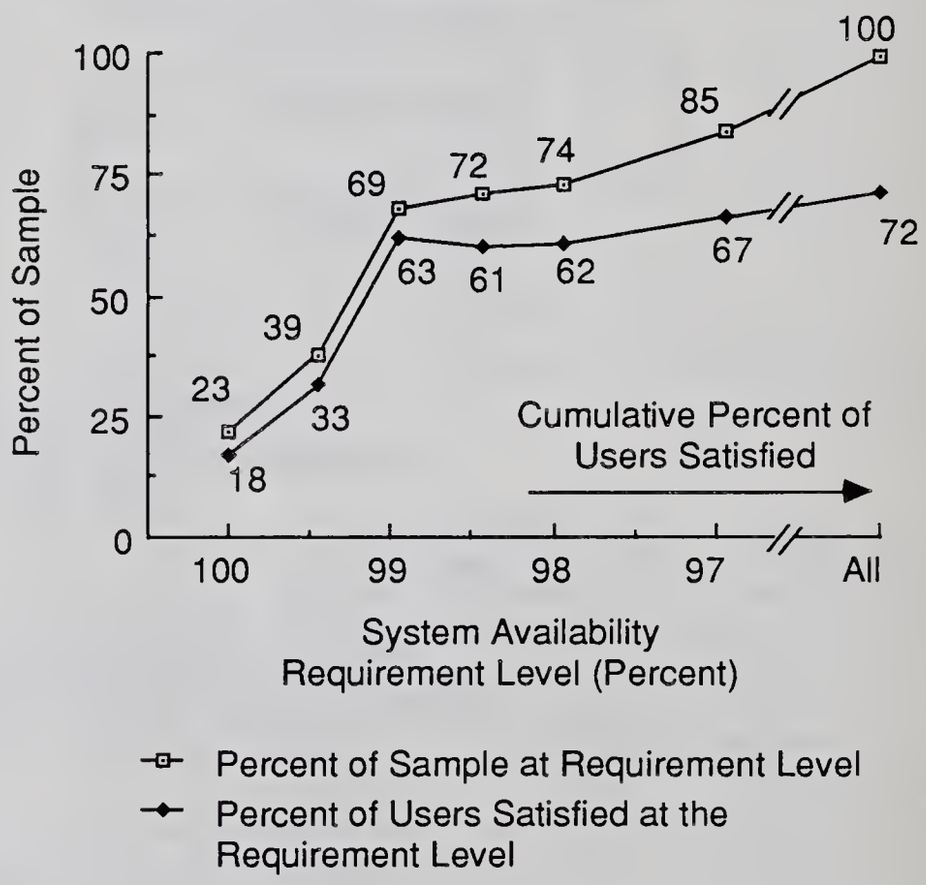
IBM's performance in the area of system availability is consistent at virtually all system availability requirement levels, as demonstrated in Exhibit IV-38. Note that even at the high requirement level of 99%, IBM was able to satisfy 63% of users with that requirement (as a point of reference, only 50% of the overall large-system users were satisfied at the 99% system availability level).

EXHIBIT IV-38



IBM 309X users have high expectations for all service areas, particularly in hardware maintenance. Exhibit IV-39 indicates that the 309X users report extremely high requirements for HW engineer skill level, spare parts availability, and HW maintenance overall (the second highest among large-system users, behind those of Amdahl). Still, IBM service performance in these areas continues to satisfy the majority of users. Exhibit IV-40 demonstrates that the percentage of users satisfied increased in the areas of HW maintenance overall and spares availability. Only in the area of HW engineer skill level did user satisfaction decline from 1988 to 1989.

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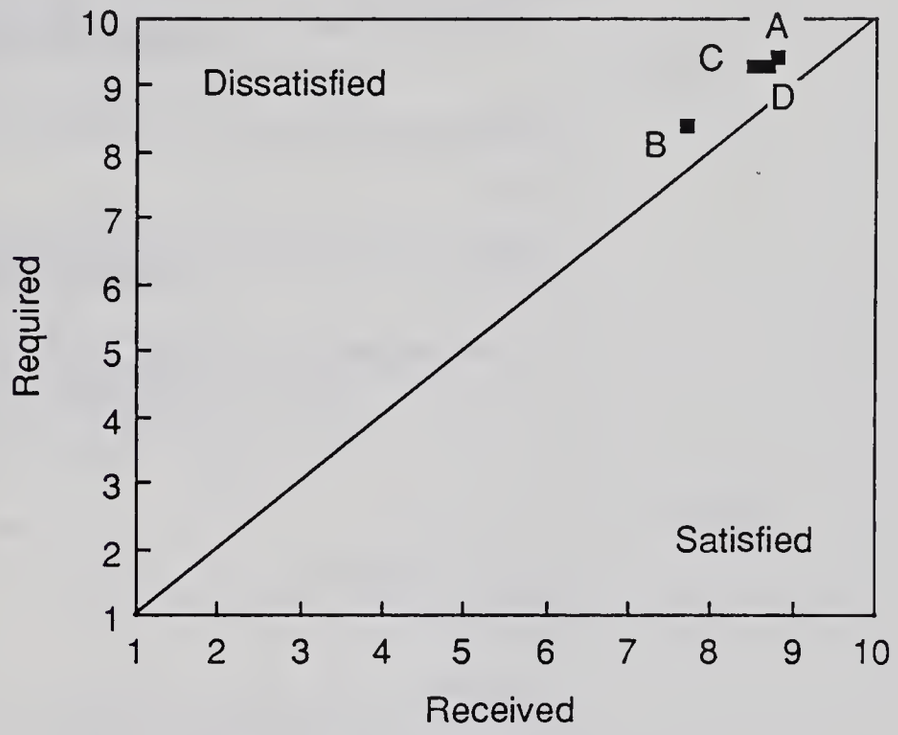
EXHIBIT IV-39

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED IBM 309X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	9.4	0.1	8.8	0.1
B	HW Remote Support	8.4	0.4	7.7	0.4
C	Spare Parts	9.3	0.2	8.5	0.2
D	HW Maintenance Overall	9.3	0.2	8.7	0.2

Scale 1=Low, 10=High
SE=Standard Error

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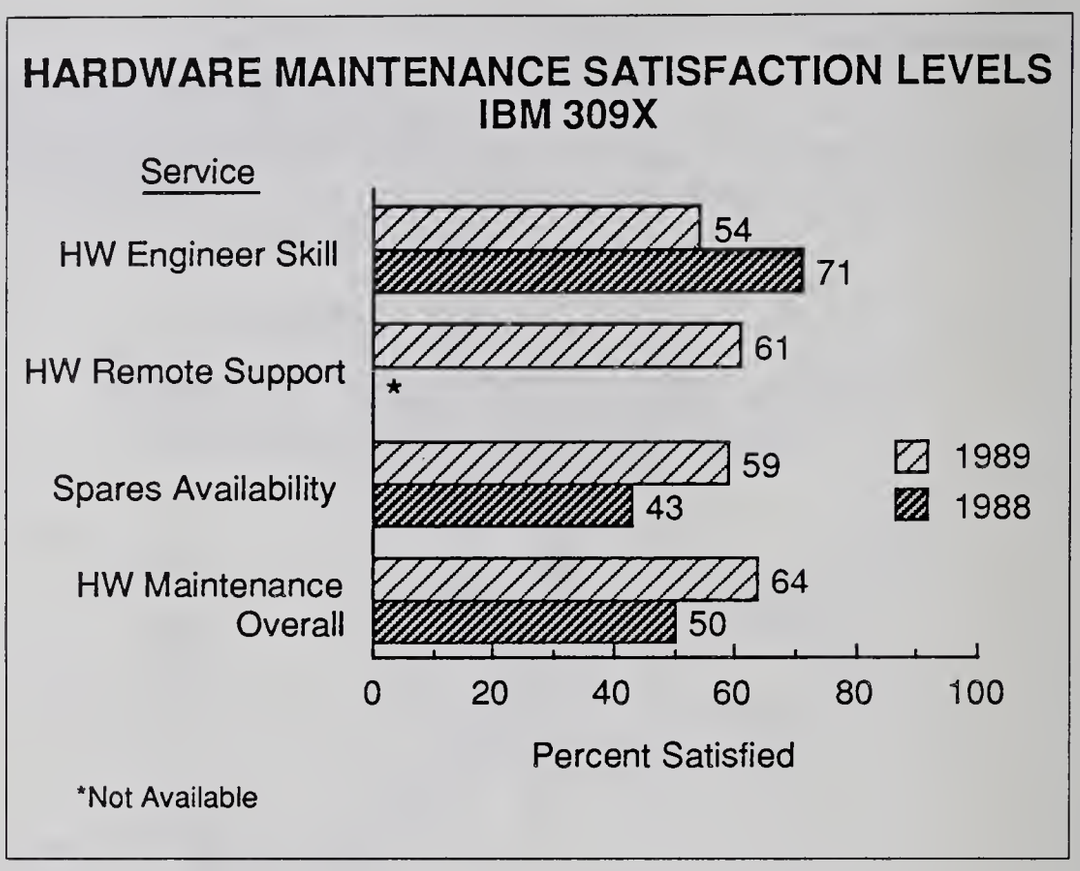
EXHIBIT IV-40



The 309X sample also reported high requirements for software support (second only to NCR users), as shown in Exhibit IV-41. Unfortunately, IBM performance in this area does not quite match its performance in the area of hardware maintenance; Exhibit IV-42 shows that the majority of IBM 309X users were dissatisfied with all areas of software support analyzed in 1989, except operational training (where 60% of the 309X sample was satisfied.). The most substantial drop in satisfaction came in the area of software remote support, where only one-third of the 309X users were satisfied, down from two-thirds in 1988.

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EXHIBIT IV-41

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED IBM 309X

Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	9.4	0.2	7.8	0.4
B	SW Remote Support	9.0	0.2	7.7	0.3
C	SW Documentation	9.3	0.2	7.6	0.3
D	Operational Training	7.0	0.7	6.1	0.6
E	SW Support Overall	9.1	0.2	7.8	0.3

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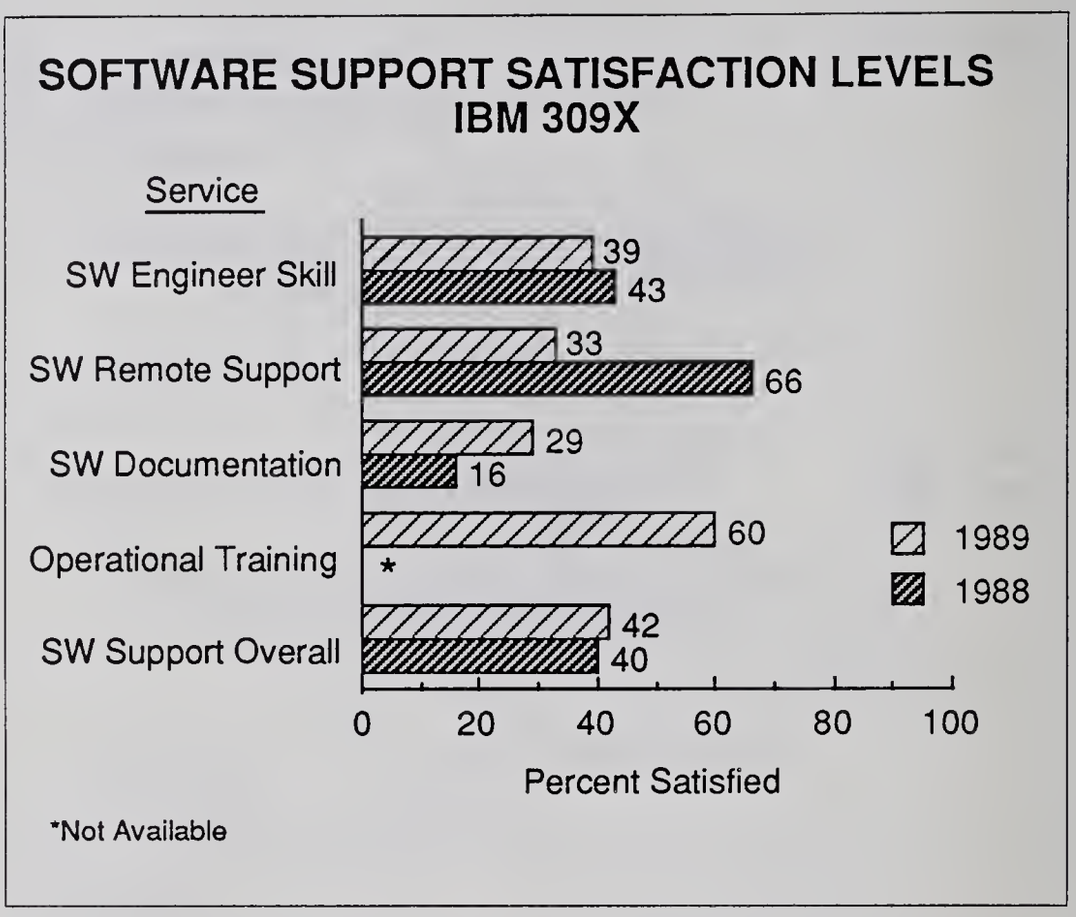
EXHIBIT IV-42



Surprisingly, the 309X user sample reported fairly low requirements for many of the ancillary services examined in Exhibit IV-43. IBM has traditionally emphasized the importance of planning, consulting, and installation services to the continued operation of its systems. Although user satisfaction with these areas is fairly high (Exhibit IV-44 shows that IBM satisfies two-thirds of its 309X users in each of these areas), IBM's performance in the area of network design and planning still falls short of user expectations (although user satisfaction grew from 28% in 1988 to 44% in 1989). Since network growth in IBM sites is a foregone conclusion, IBM will need to pay closer attention to this service area in the future (IBM has announced a new network support offering in the last year).

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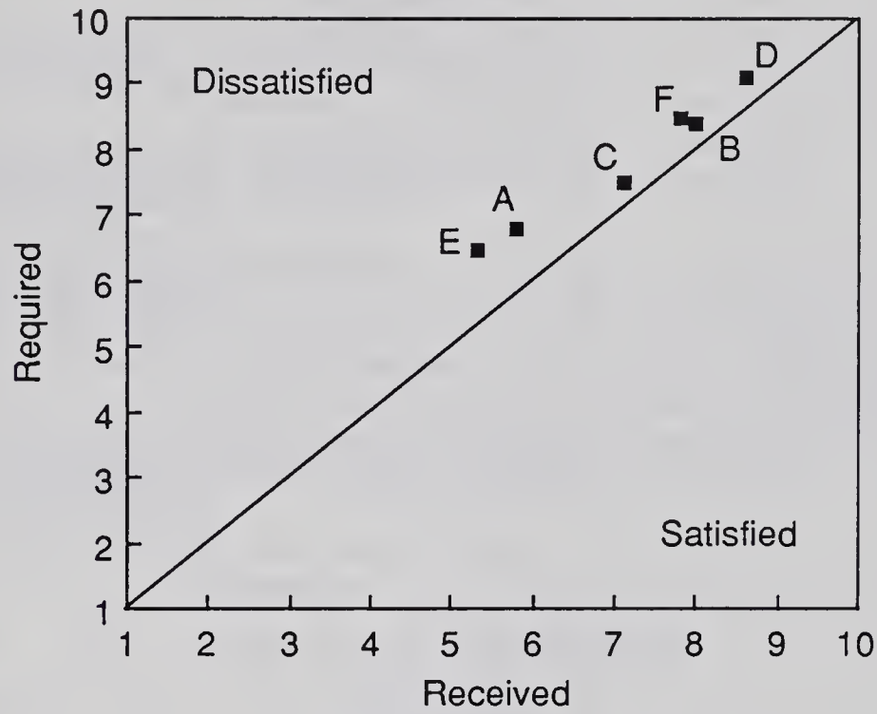
EXHIBIT IV-43

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED IBM 309X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.8	0.5	5.8	0.6
B	Preinstallation Planning	8.4	0.3	8.0	0.4
C	Consulting	7.5	0.4	7.1	0.4
D	Installation/ Deinstallation	9.1	0.2	8.6	0.2
E	Network Designs/ Planning	6.5	0.6	5.3	0.6
F	Ancillary Services Overall	8.5	0.3	7.8	0.3

Scale 1=Low, 10=High
SE=Standard Error

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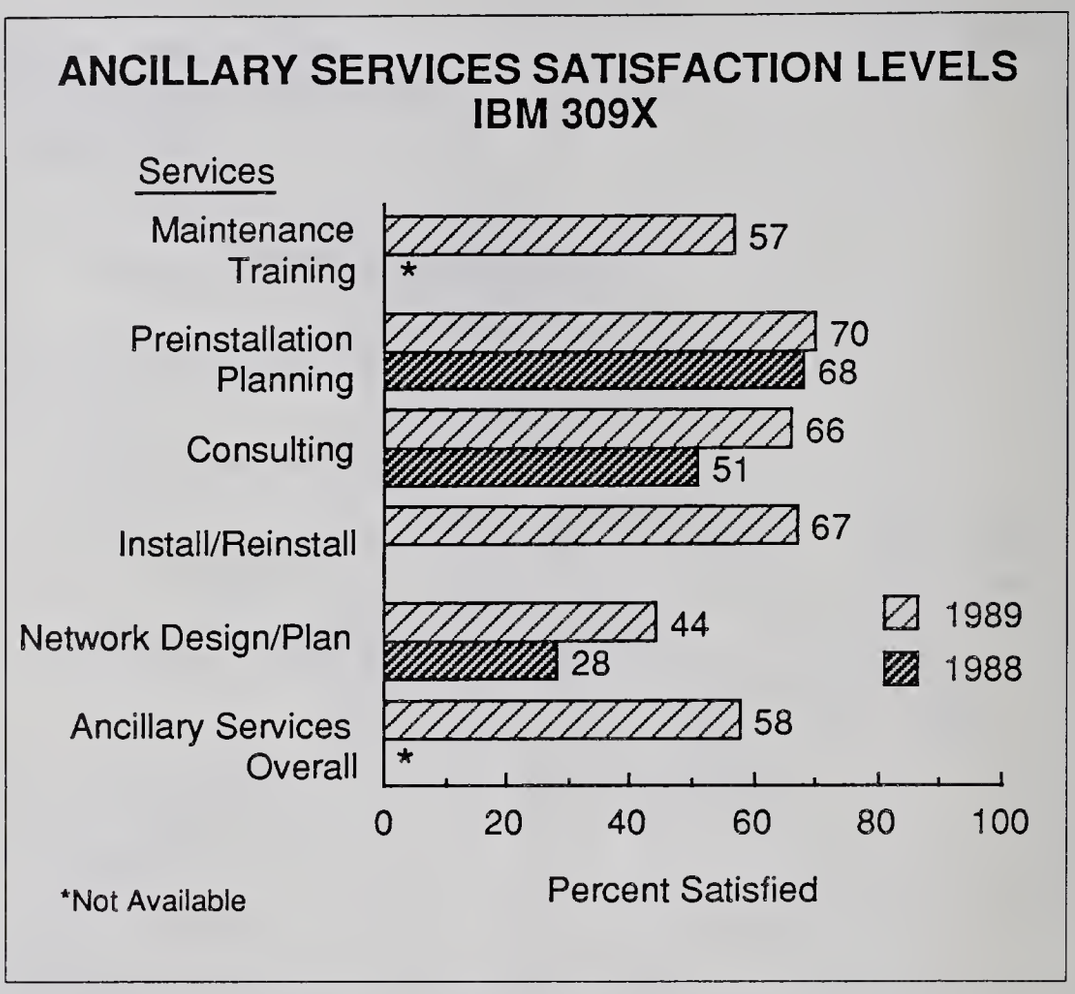
EXHIBIT IV-44



Although IBM has been a traditional target for third-party maintenance, the cost of spare parts, diagnostics, and normal large-system user reluctance to switch to TPM has slowed TPM encroachment into the 309X user base. Still, 17 of the 309X users reported that they were contacted by TPMs in the last twelve months (5 reported more than one contact). TPMs mentioned most frequently were Sorbus (with 7 mentions); CDC (with 4 mentions); and TRW and NAS (with 2 mentions each). Reasons for not switching centered on satisfaction with IBM ("Why bother switching" and "IBM service too good") or fear of switching ("It's not worth the risk" and "Do not want to take the chance").

In summary, IBM service strengths reported by 309X users include system availability, response and repair time, operational training, and preinstallation planning. Areas of concern include software support, software documentation, and network planning and design.

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E

IBM 308X

In 1989, INPUT surveyed forty users of IBM 308X mainframe systems, broken down into the following models: twenty-five 3081s, nine 3083s, five 3084s, and one 3088. The 308X user sample can also be broken down into the following industries: ten process manufacturers, five insurance users, five discrete manufacturers, four banking and finance users, four retail distributors, three other industry-specific users, two transportation users, two wholesale users, and one each from education, federal government, services, telecommunications, and utilities.

Exhibit IV-45 presents the typical service coverage reported by the 308X users. Much in the same way as the IBM 309X user sample, a few of the 308X users reported that their service contract covered something less than 24 hours per day, 7 days per week. Again, either the IBM users were unaware that IBM expanded all large- and small-system contract coverage to 24X7 in 1987, or a few IBM users have negotiated discounted, reduced contract coverage (most likely the former).

EXHIBIT IV-45

CONTRACT COVERAGE
IBM 308X

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	8	7
Monday - Saturday	0	0
Monday - Sunday	92	93
Hours Covered		
1 - 9 Hours	8	2
10 - 16	2	3
16 - 24	90	95

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Much like the 309X user sample, the 308X users reported a significant improvement in system reliability in 1989. Exhibit IV-46 demonstrates that the mean number of system interruptions experienced by 308X users dropped from 1.2 in 1988 to 0.5 per month in 1988. This improvement continues a trend first observed in the 1988 report, as system interruptions dropped in 1988 from 2.0 per month in 1987. The 1988 report attributed the improvement from 1987 to 1988 to improved hardware reliability. In 1989, hardware reliability also contributed to the reduction of system interruptions (hardware-related problems dropped from 0.5 per month to well under 0.3 per month in 1989). At the same time, the percentage of software problems also improved, accounting for 16% of all system interruptions in 1989, down from 38% of the 1987 problems.

EXHIBIT IV-46

SYSTEM INTERRUPTION ANALYSIS
IBM 308X
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.5	0.1	1.2	0.2
Hardware-Caused	51	7.5	41	5.7
System-Software-Caused	11	3.8	25	4.2
Application-Software-Caused	5	3.4	13	3.5
Other-Caused	33	7.2	21	5.2

SE=Standard Error

Accordingly, IBM performance in the area of system availability improved as well in 1989. Exhibit IV-47 indicates that IBM mean system availability performance met the 308X user expectation of 98.6% system availability. More significantly, IBM easily beat their users' reported response time requirement (of 2 hours) with a 0.9-hour response time average. As a result, IBM increased the percentage of 308X users who were satisfied in all traditional support performance measurements, as shown in Exhibit IV-48. The greatest increase in user satisfaction appro-

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EXHIBIT IV-47

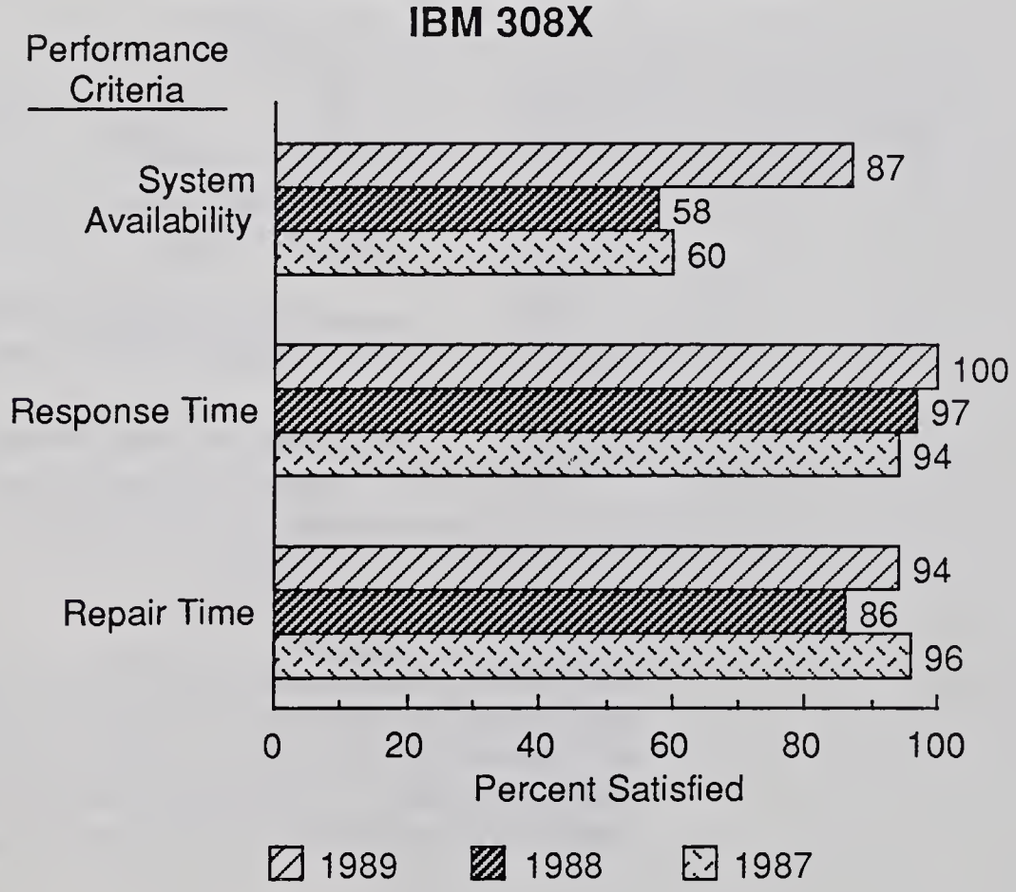
SYSTEM AVAILABILITY PERFORMANCE ANALYSIS IBM 308X

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	98.6	0.3	98.8	0.3
Response Time (Hrs)	2.0	0.1	0.9	0.1
Repair Time (Hrs)	2.4	0.3	2.1	0.3

SE=Standard Error

EXHIBIT IV-48

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION IBM 308X



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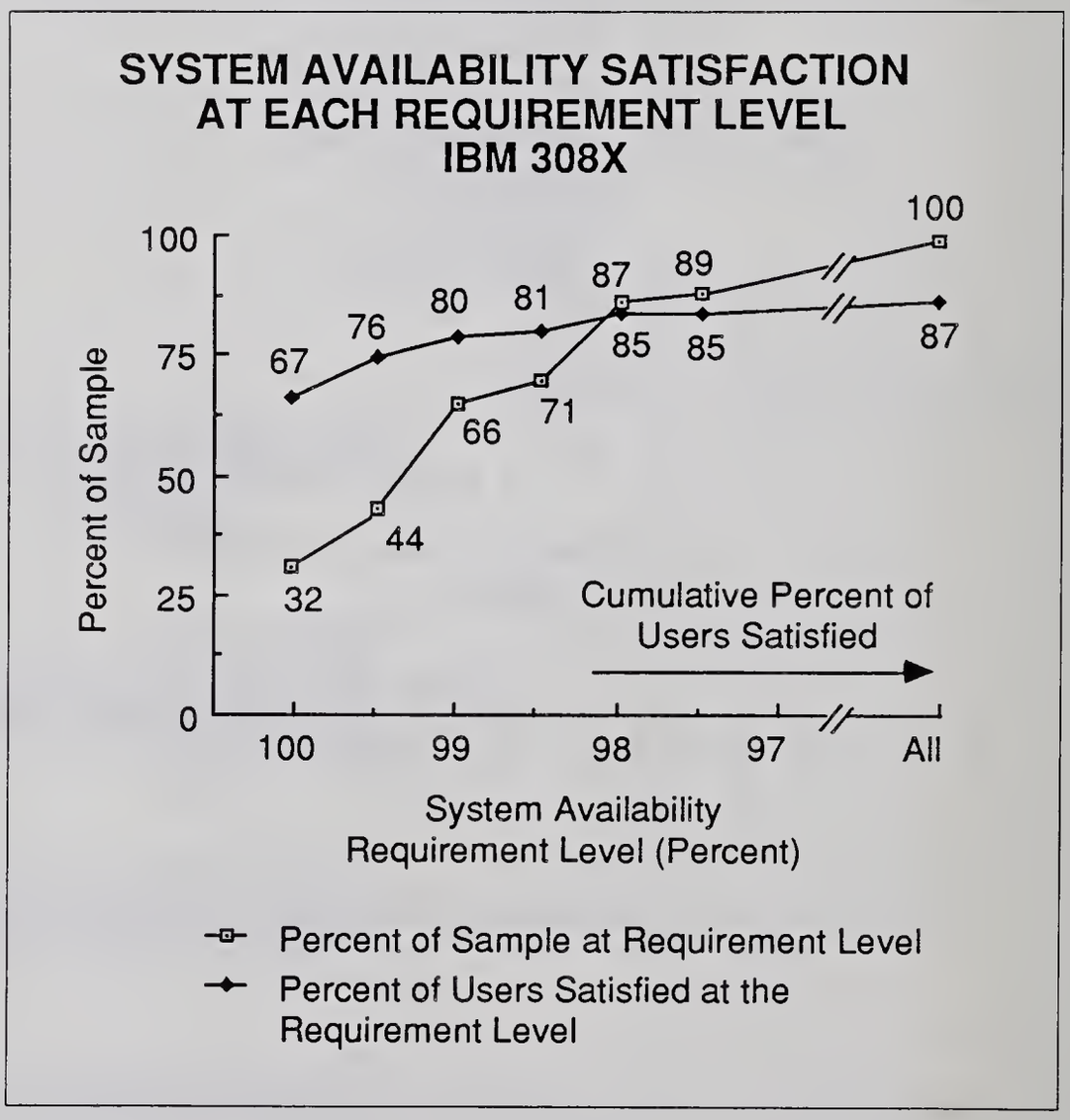
priately came in the area of system availability (with 87% of the 308X sample satisfied, up from 58% in 1988), yet response time satisfaction is noteworthy in that IBM satisfied 100% of the 308X users surveyed (as it did for the 309X sample analyzed earlier in this report).

In fact, IBM's system availability performance is even more commendable after examining Exhibit IV-49, which demonstrates that IBM satisfied over three-quarters of users with system availability requirements of 99.5% or greater and, even more impressively, two-thirds of users with system availability requirements of 100%!

EXHIBIT IV-49



IBM 308X user satisfaction with service extends to the area of hardware maintenance, as demonstrated in Exhibits IV-50 and IV-51. In each hardware maintenance service category analyzed, 308X user satisfaction grew significantly, to the point that well over two-thirds of the 308X sample was satisfied with overall hardware maintenance.

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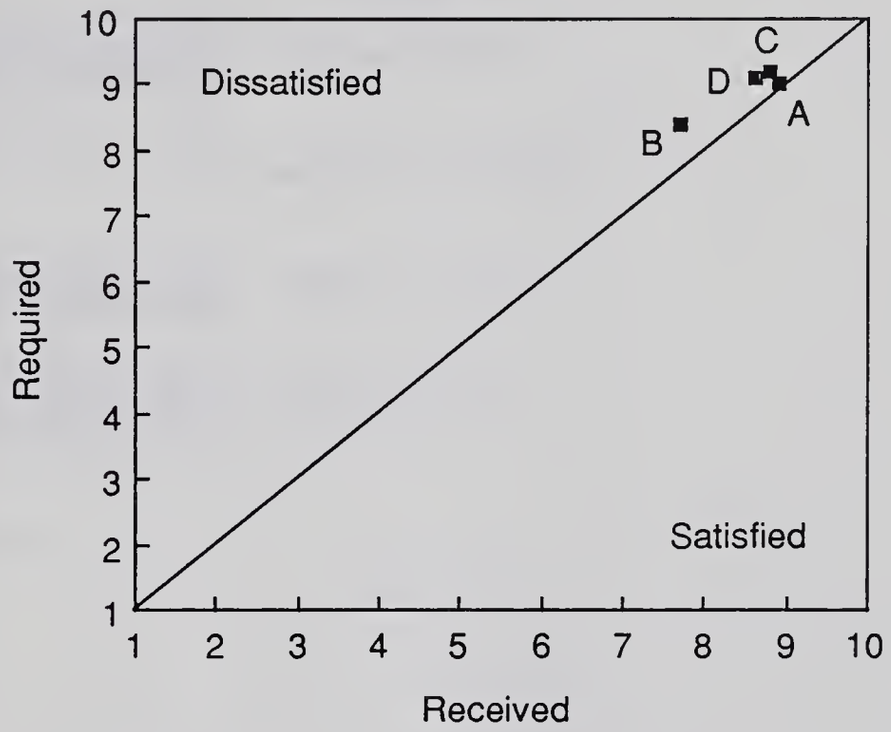
EXHIBIT IV-50

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED IBM 308X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	9.0	0.2	8.9	0.2
B	HW Remote Support	8.4	0.2	7.7	0.3
C	Spare Parts	9.2	0.2	8.8	0.2
D	HW Maintenance Overall	9.1	0.2	8.6	0.3

Scale 1=Low, 10=High
SE=Standard Error

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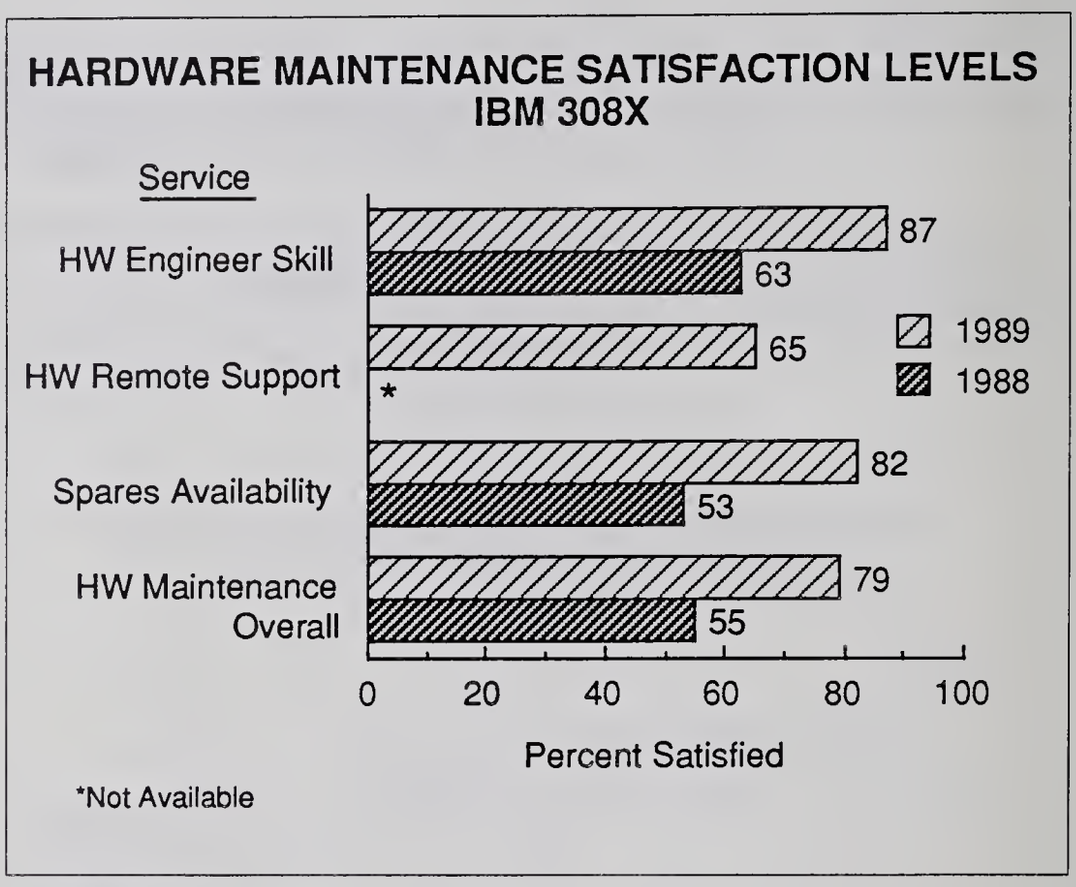
EXHIBIT IV-51



IBM was more successful at satisfying the 308X users in the area of software support than it was at satisfying the 309X users, although Exhibit IV-52 (as compared to Exhibit IV-41) indicates that the 308X user sample reported significantly lower requirements for most areas of software support analyzed. As a result, IBM had a considerably easier task of meeting those requirements, as demonstrated in Exhibit IV-53. User satisfaction with software documentation increased most dramatically, from 23% in 1988 to 71% in 1989. In fact, IBM performance in this area is notable in that IBM was the only large-system vendor to satisfy the majority of its users with respect to software documentation.

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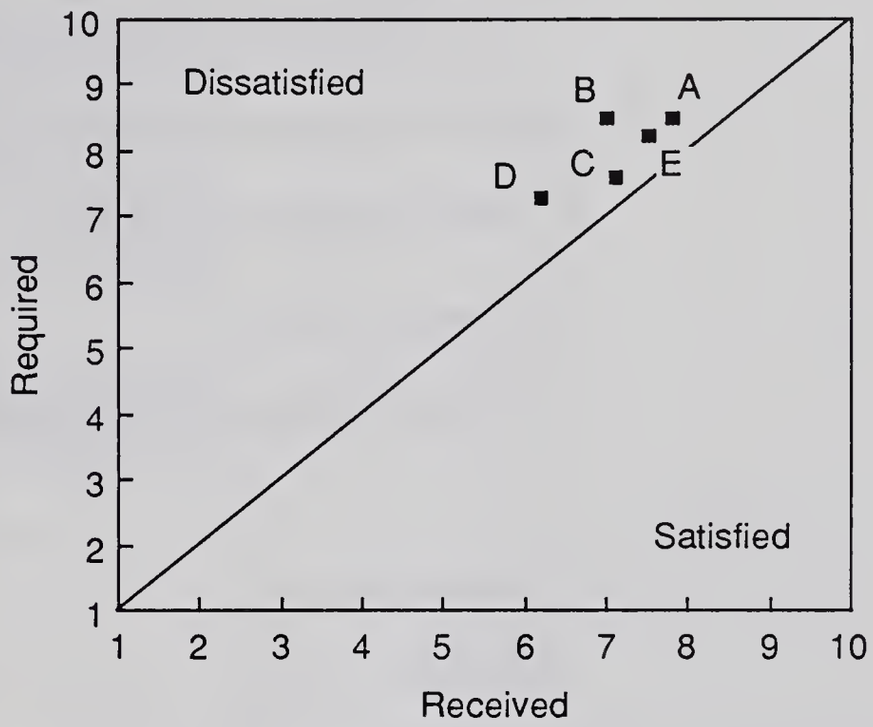
EXHIBIT IV-52

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED IBM 308X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	8.5	0.2	7.0	0.5
B	SW Remote Support	8.5	0.3	7.8	0.3
C	SW Documentation	7.6	0.5	7.1	0.4
D	Operational Training	7.3	0.4	6.2	0.6
E	SW Support Overall	8.2	0.3	7.5	0.3

Scale 1=Low, 10=High
SE=Standard Error

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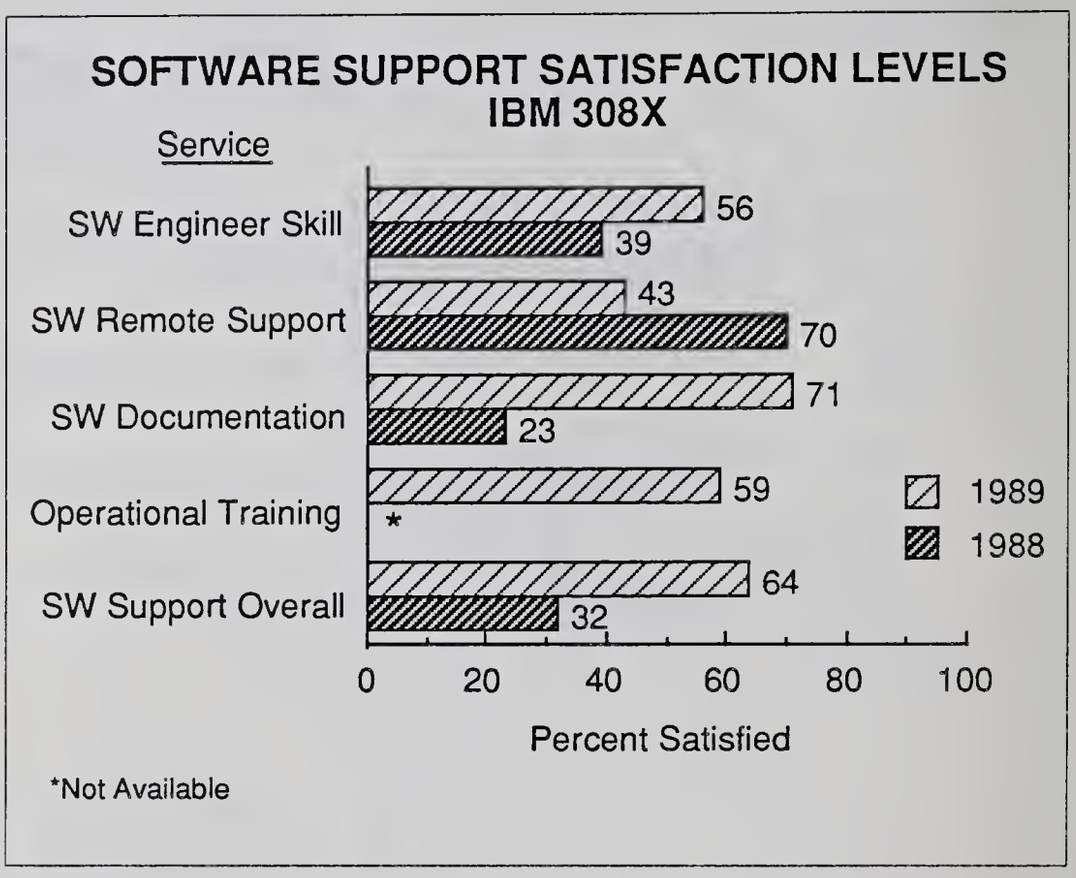
EXHIBIT IV-53



IBM was also successful at satisfying the majority of the 308X users with regard to ancillary services delivered, as shown in Exhibits IV-54 and IV-55. Just as IBM was most successful in satisfying its 309X users' requirements in the areas of preinstallation planning and installation services, IBM was also most successful at satisfying the 308X users' needs in these areas. The one area where IBM failed to satisfy at least two-thirds of its 308X users was network design and planning, which incidentally was the weakest ancillary service reported by the 309X sample.

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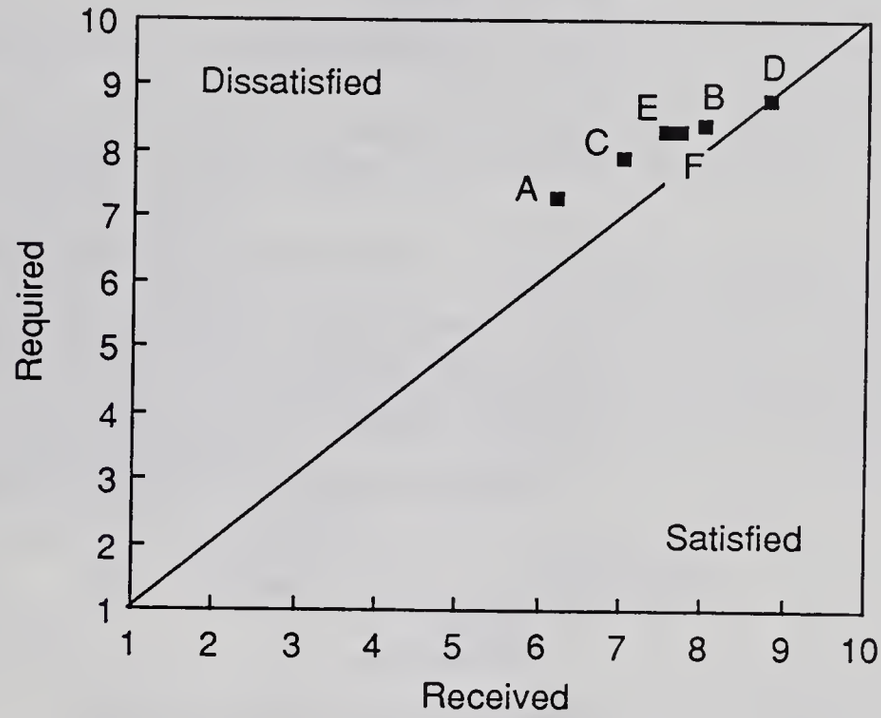
EXHIBIT IV-54

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED IBM 308X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	7.3	0.5	6.2	0.6
B	Preinstallation Planning	8.4	0.3	8.0	0.4
C	Consulting	7.9	0.4	7.0	0.5
D	Installation/ Deinstallation	8.8	0.2	8.8	0.2
E	Network Designs/ Planning	8.3	0.4	7.5	0.4
F	Ancillary Services Overall	8.3	0.3	7.7	0.3

Scale 1=Low, 10=High
SE=Standard Error

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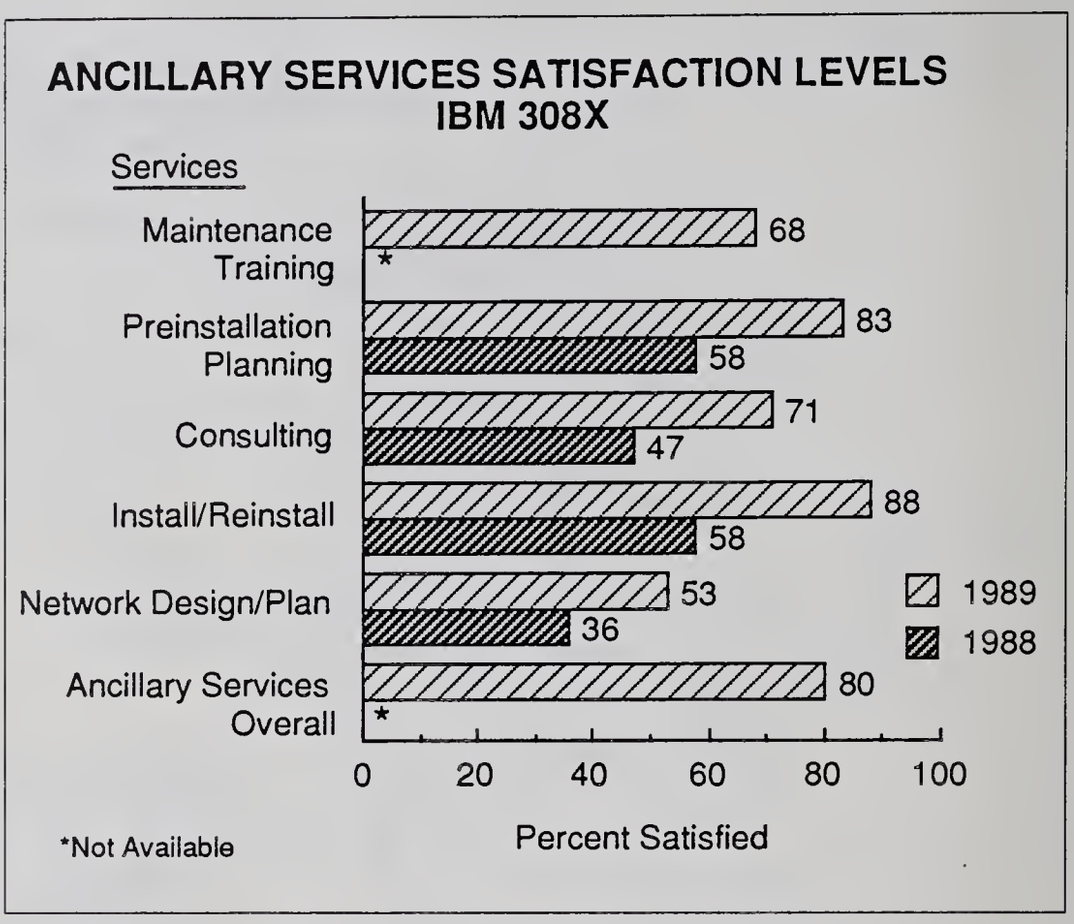
EXHIBIT IV-55



Because the 308Xs are older products in IBM's large-system product line, it is not surprising that a greater number of the 308X sample (21 users) reported that they had been contacted by third-party maintenance companies in the past year. TPMs most active in the pursuit of these 308X users were Sorbus (with 13 mentions), CDC (with 8 mentions), and TRW (with 3 mentions). Most turned down the TPMs due to satisfaction with IBM or concern that the TPM would not be able to deliver the same level of service as IBM.

The 308X users were queried as to what service they would like IBM to provide in the future. Three users requested IBM service on their non-IBM products, a reflection of satisfaction with IBM service quality, as well as an indication of a user desire for a single-source of support. Ironically, IBM recently announced that it would provide service on non-IBM products, thus essentially responding to such requests.

In summary, IBM service performance strengths reported by the 308X users included product reliability, system availability, response and repair time, hardware engineer skill level, spares availability, software documentation, and installation services. Network design represented IBM's one area that warrants attention.

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F

National Advance Systems (NAS)

In 1989, INPUT surveyed forty users of National Advance Systems (NAS) mainframe systems. The sample can be broken into the following models: twenty AS/8XXX, eleven AS/9XXX, and nine AS/XLs. NAS users came from the following industries: fourteen service users, five users from state and local governments, five insurance users, three educational users, three process manufacturers, two discrete manufacturers, two utilities, and one each from federal government, banking and finance, medical, telecommunications, transportation, and other industry-specific.

Exhibit IV-56 presents a look at the typical contract service coverage reported by the NAS user sample. NAS, as well as IBM and Amdahl, provide 24-hour, 7-day coverage as the standard service coverage. NAS also offers discounted coverage to users who would prefer 5-day, 9-hour service (currently a 28% discount). In 1989, 25% of the NAS sample reported that they opted for the reduced-coverage plan, bucking the large-system trend of around-the-clock coverage.

EXHIBIT IV-56

CONTRACT COVERAGE
NAS

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	25	13
Monday - Saturday	3	2
Monday - Sunday	72	85
Hours Covered		
1 - 9 Hours	25	9
10 - 16	3	8
16 - 24	72	83

NAS equipment has been traditionally well regarded with respect to system reliability. Exhibit IV-57 indicates that system reliability declined somewhat in 1989, with the NAS user sample reporting an average of 0.6 system interruptions per month, versus 0.4 per month in 1988. Users reported that hardware-related and other-caused (either environmental or user-related) problems increased in 1989.

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EXHIBIT IV-57

SYSTEM INTERRUPTION ANALYSIS
NAS
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.6	0.2	0.4	0.1
Hardware-Caused	43	8.4	36	8.1
System-Software-Caused	27	6.0	25	6.1
Application-Software-Caused	11	5.0	28	8.0
Other-Caused	19	7.5	11	5.1

SE=Standard Error

Exhibit IV-58 also points out that user expectations for system availability exceeded NAS system availability performance, even though response and repair time actuals easily met user requirements. What this suggests is that a small number of NAS users reported extraordinarily low system availability actuals, supported by the finding—presented in Exhibit IV-59—that 68% of the NAS user sample was satisfied by the system availability that they received. Still, NAS should be concerned that satisfaction in system availability, response time, and repair times all went down measurably in 1989.

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EXHIBIT IV-58

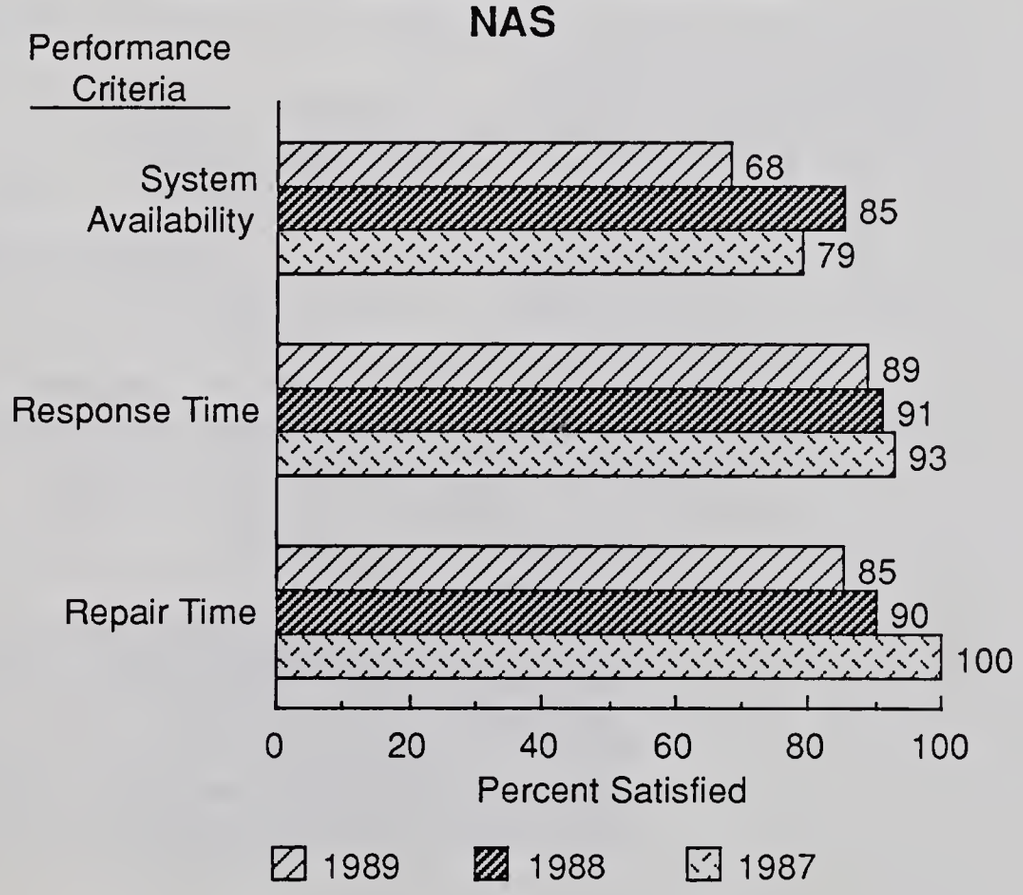
SYSTEM AVAILABILITY PERFORMANCE ANALYSIS NAS

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	99.2	0.2	98.3	0.6
Response Time (Hrs)	1.6	0.1	1.2	0.1
Repair Time (Hrs)	2.1	0.4	1.7	0.3

SE=Standard Error

EXHIBIT IV-59

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION NAS



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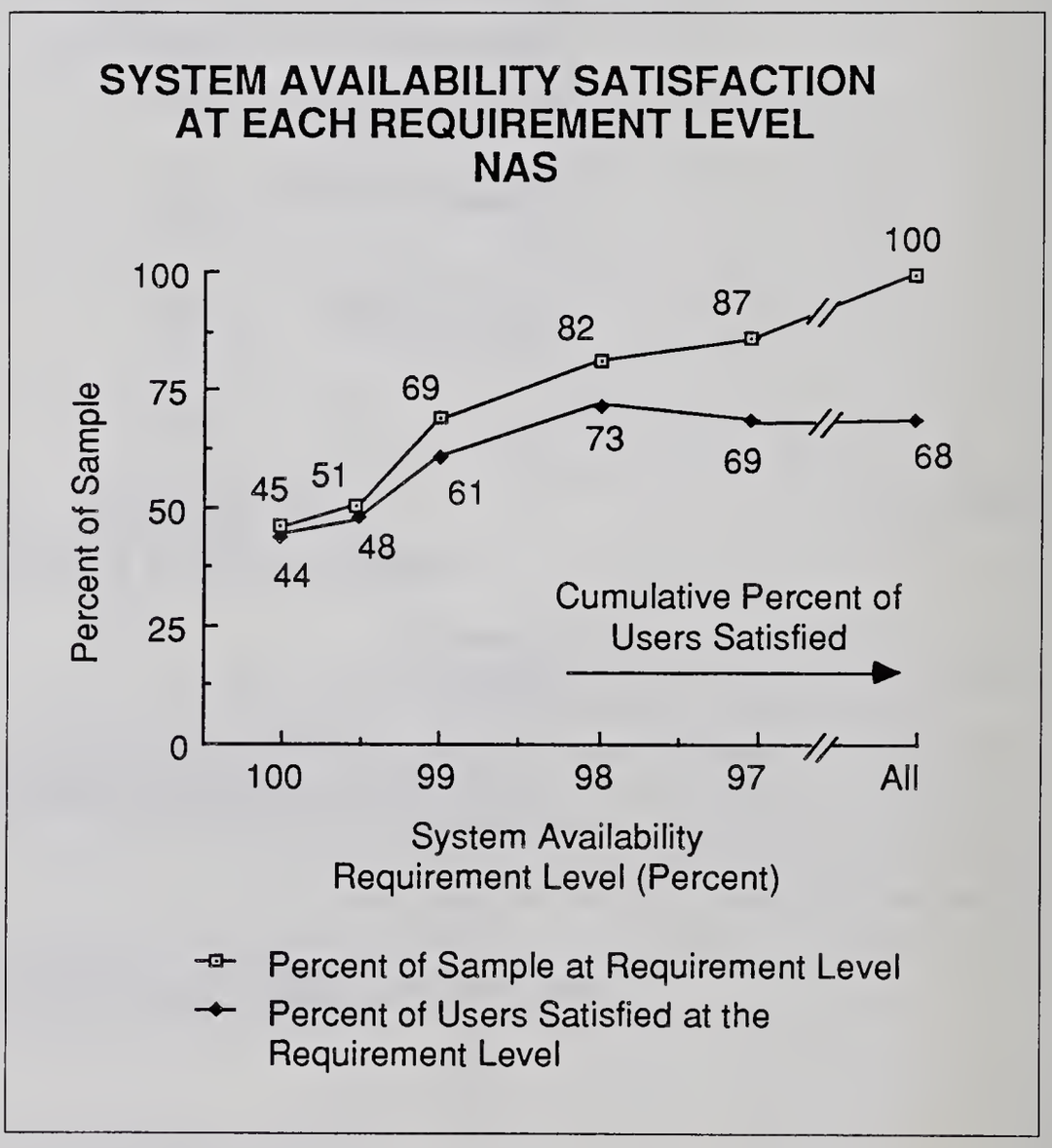
It should be emphasized that NAS large systems are marketed on the strength of their reliability. As a result, user expectations for system availability are quite high. For example, Exhibit IV-60 demonstrates that 45% of the NAS sample reported system availability expectations of 100%. It is to NAS's credit that it was able to satisfy 44% of users with that high expectation. Nonetheless, NAS system availability performance has declined in 1989 (NAS was able to satisfy 71% of the 1988 sample that required 100% system availability).

EXHIBIT IV-60



For a user group that reports such high system availability requirement levels, the NAS users reported extremely low requirements for hardware maintenance, as shown in Exhibit IV-61. In 1988, the NAS respondents rated their requirements for such hardware maintenance areas as HW engineer skill level, parts availability, and HW maintenance at the 9.0 level and above. The 1989 sample rated these areas much lower.

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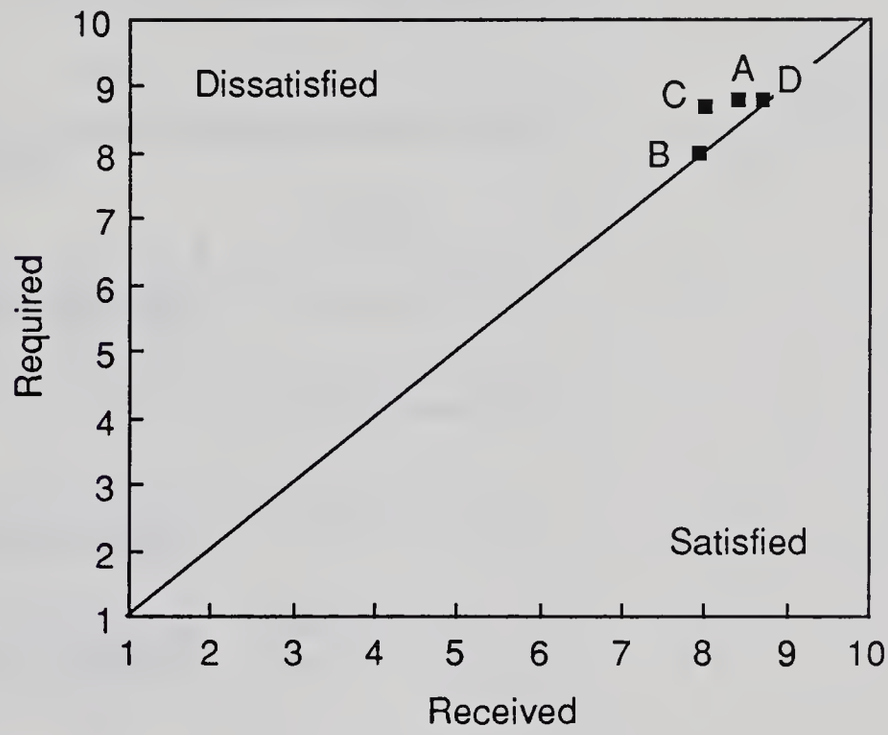
EXHIBIT IV-61

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED NAS



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	8.8	0.2	8.4	0.2
B	HW Remote Support	8.0	0.3	7.9	0.3
C	Spare Parts	8.7	0.2	8.0	0.3
D	HW Maintenance Overall	8.8	0.2	8.7	0.2

Scale 1=Low, 10=High
SE=Standard Error

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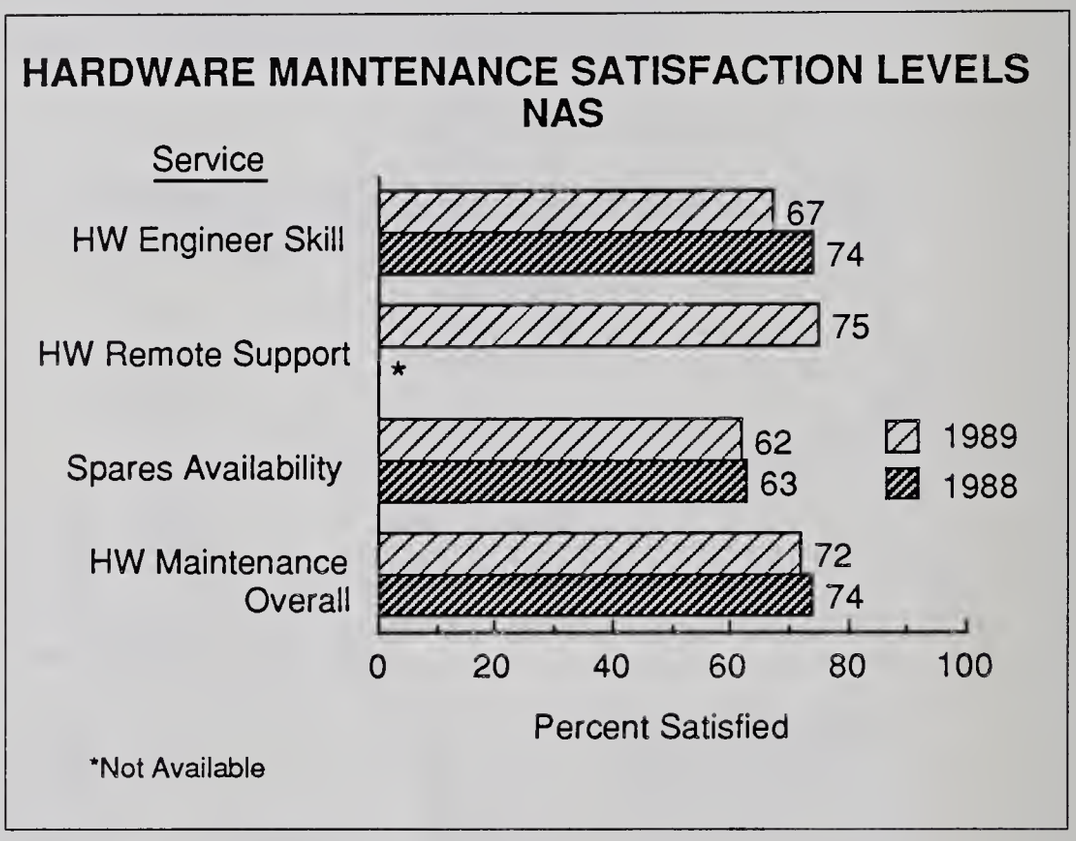
In most areas, user satisfaction has not changed appreciably, as shown in Exhibit IV-62. NAS user satisfaction with hardware maintenance continues to stay quite high, with seven out of ten NAS users satisfied with HW maintenance overall. Even in the critical area of parts availability, NAS manages to satisfy 62% of its users.

EXHIBIT IV-62



NAS, like Amdahl, sells systems that are designed to be compatible with IBM mainframes, hence the term *plug compatible*. As such, NAS (and Amdahl) are more commonly associated with hardware, since software and peripheral products that are designed to run on IBM mainframes are able to plug right into the NAS (Amdahl) system. Still, both NAS and Amdahl do provide a certain amount of software support to their users, typically in the form of telephone support.

Exhibit IV-63 suggests that NAS users do not have a high requirement for software support from NAS. In fact, so few NAS users responded to questions regarding software support (specifically SW remote support and SW documentation) that it became difficult, if not impossible, to accurately gauge user satisfaction. Still, NAS users appeared to be very satisfied with whatever amount of software support they received from NAS, as shown in Exhibit IV-64. In fact, user satisfaction with SW engineer skill level and overall satisfaction with software support almost doubled over last year's results.

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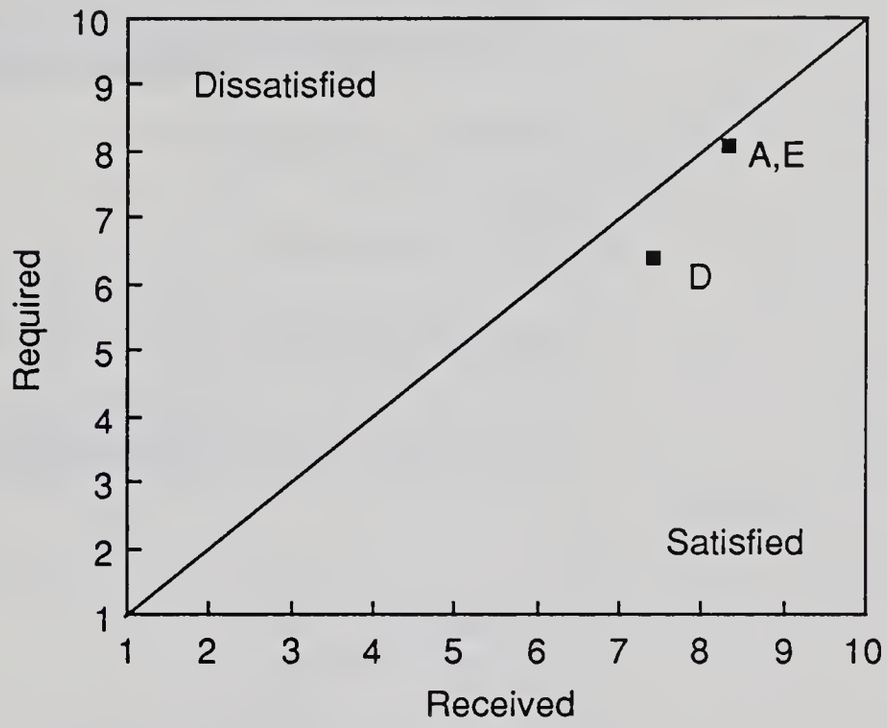
EXHIBIT IV-63

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED NAS



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	8.1	0.4	8.3	0.4
B	SW Remote Support	**	**	**	**
C	SW Documentation	**	**	**	**
D	Operational Training	6.4	1.0	7.4	0.9
E	SW Support Overall	8.1	0.4	8.3	0.4

**Insufficient Response
Scale 1=Low, 10=High
SE=Standard Error

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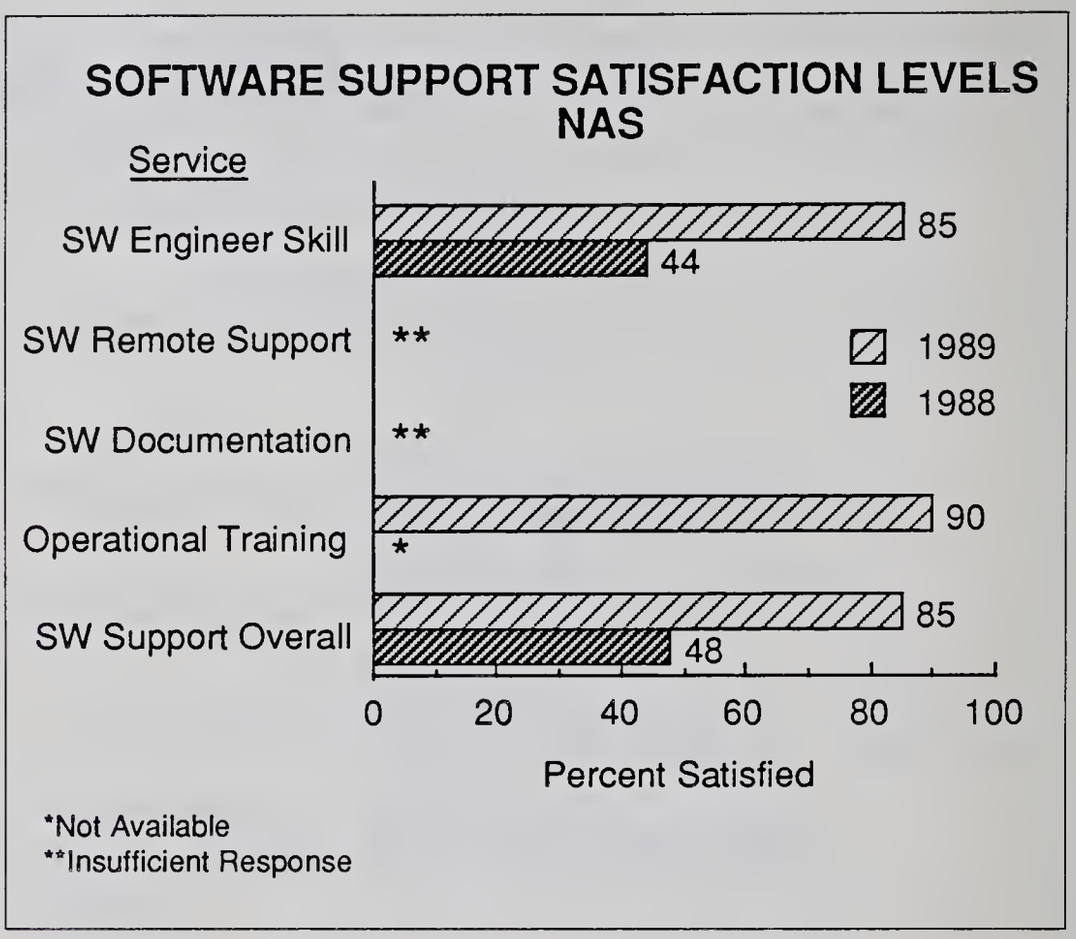
EXHIBIT IV-64



NAS users did recognize the importance of ancillary service, as analyzed in Exhibit IV-65. By and large, NAS actual performance approached user requirements in all areas except for maintenance-related training, which still satisfied 50% of the users, as shown in Exhibit IV-66. In all other ancillary service areas, NAS satisfied two-thirds or more of its users, demonstrating improved performance in all areas except network design/planning.

Few third-party maintenance organizations have targeted NAS products. Only seven of the NAS respondents reported that they were contacted by a TPM in the past year, with CDC (3 mentions), Sorbus (2 mentions), and DPCE the most recognizable TPMs mentioned. By and large, the NAS users declined to switch because they felt they received good service for a reasonable price.

When questioned as to what their primary service concern was, the NAS sample most often, and not surprisingly, mentioned system availability and parts availability. Additional services required were software support on third-party software (mentioned by three NAS users) and on-site (dedicated) field engineers (two mentions).

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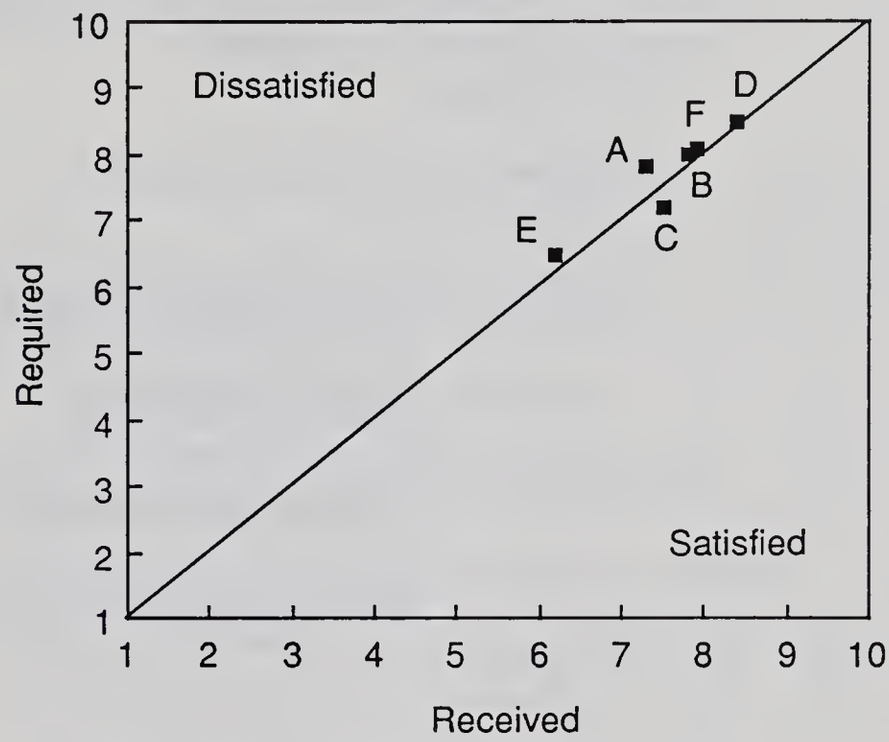
EXHIBIT IV-65

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED NAS



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	7.8	0.5	7.3	0.3
B	Preinstallation Planning	8.0	0.3	7.8	0.3
C	Consulting	7.2	0.5	7.5	0.5
D	Installation/ Deinstallation	8.5	0.3	8.4	0.3
E	Network Designs/ Planning	6.5	0.7	6.2	0.7
F	Ancillary Services Overall	8.1	0.3	7.9	0.4

Scale 1=Low, 10=High
SE=Standard Error

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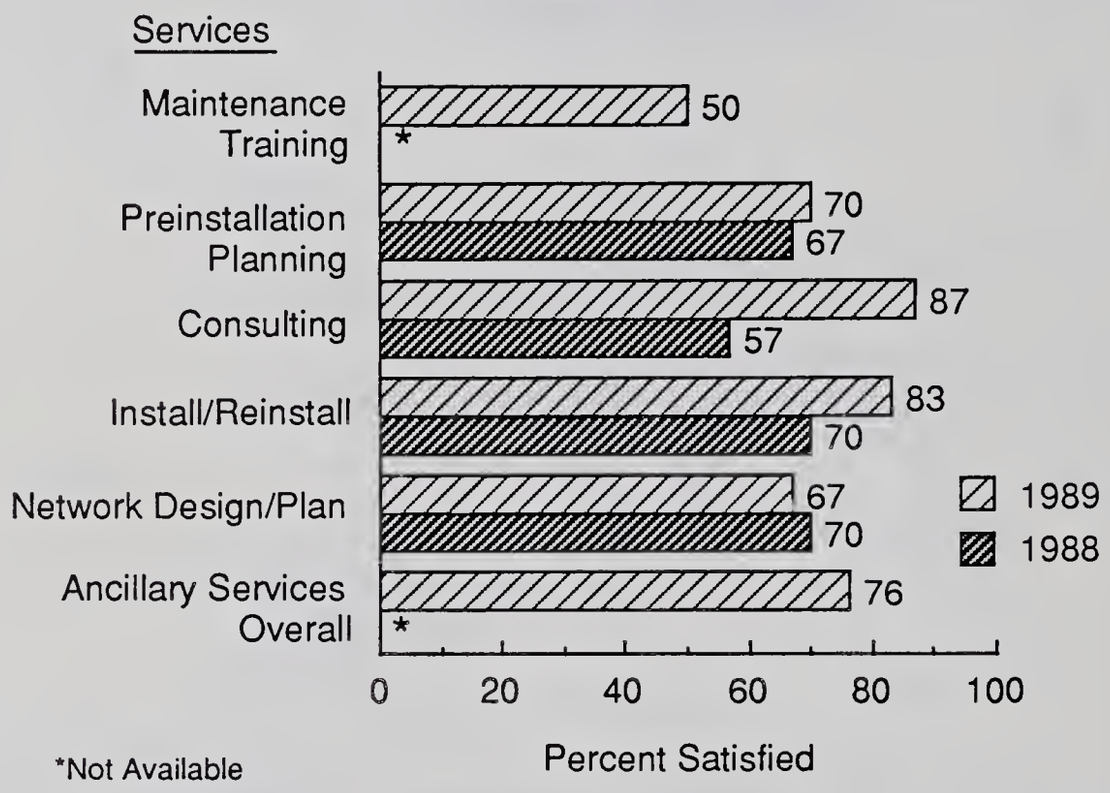
EXHIBIT IV-66



In summary, NAS strengths include product reliability, response times, and hardware maintenance overall. Although the NAS users did not report any significant problem area, maintenance-related training represented NAS's weakest performance area (with 50% satisfied).

G

NCR

In 1989, INPUT surveyed forty users of NCR mainframes, all of which were from the 9300 product family. Industries represented in the NCR user sample include medical (with 10 users), process manufacturing (9 users), discrete manufacturing (5 users), services (4 users), other industry-specific (3 users), banking and finance (2 users), education (2 users), retail (2 users), wholesale (2 users), and transportation (1 user).

Approximately three-quarters of the NCR users report that they receive single-shift coverage (Monday through Friday, nine hours per day), as shown in Exhibit IV-67. Since the NCR system analyzed does not compete directly with systems from IBM (the 309X), NAS, and Amdahl,

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it is unlikely that around-the-clock coverage will become standard unless other system manufacturers follow IBM's lead in expanding basic coverage.

EXHIBIT IV-67

CONTRACT COVERAGE
NCR

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	73	75
Monday - Saturday	0	5
Monday - Sunday	27	20
Hours Covered		
1 - 9 Hours	70	60
10 - 16	3	28
16 - 24	27	12

The NCR users reported that their systems were much more reliable in 1989. Exhibit IV-68 indicates that mean system interruptions dropped from 1.6 per month in 1988 to only 0.6 per month. Even though the percentage of hardware-caused system failures increased, the number of hardware problems actually dropped from 0.9 per month to 0.4 per month. Also, the NCR sample indicated that system failures caused by "other" problems (most often user-related or environmentally caused) dropped significantly, suggesting that improvements in end-user training, documentation, or preinstallation planning services were made.

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EXHIBIT IV-68

SYSTEM INTERRUPTION ANALYSIS
NCR
(Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.6	0.1	1.6	0.5
Hardware-Caused	70	7.8	56	6.6
System-Software-Caused	20	6.8	15	4.0
Application-Software-Caused	2	1.0	9	3.8
Other-Caused	8	4.6	20	6.1

SE=Standard Error

Exhibit IV-69 analyzes NCR service performance by the more-traditional measures of system availability, response time, and repair times. System availability is within user requirements (when the standard error of the mean is taken into account); however, service response times fall well above user expectations. NCR manages, however, to satisfy only 67% of its users in this area, as shown in Exhibit IV-70. NCR shows by far the poorest performance of all large-system vendors analyzed. This also represents a substantial drop in user satisfaction from 1988, when 91% of the NCR user sample was satisfied with response time. Response time satisfaction was obviously impacted by the uneven performance reported by four users who reported they received next-day response, and by two users who reported 48-hour response!

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EXHIBIT IV-69

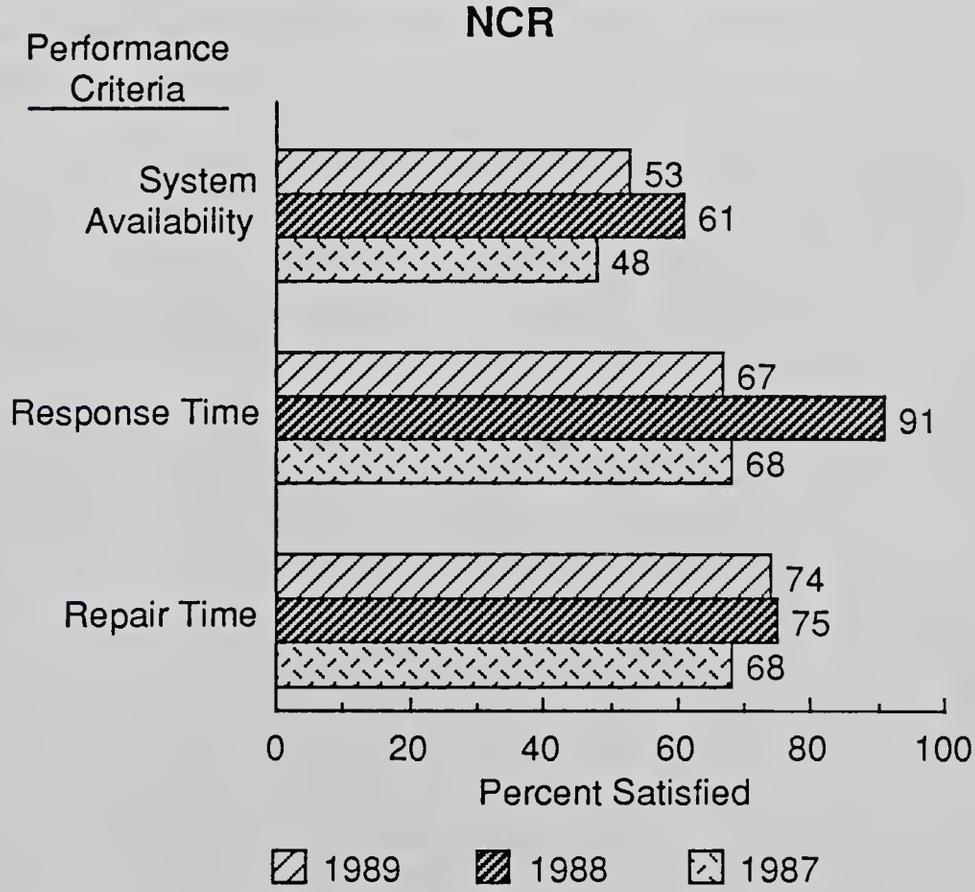
SYSTEM AVAILABILITY PERFORMANCE ANALYSIS NCR

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	97.4	0.9	96.8	0.6
Response Time (Hrs)	5.0	1.2	6.7	1.9
Repair Time (Hrs)	4.8	1.9	3.6	1.3

SE=Standard Error

EXHIBIT IV-70

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION NCR



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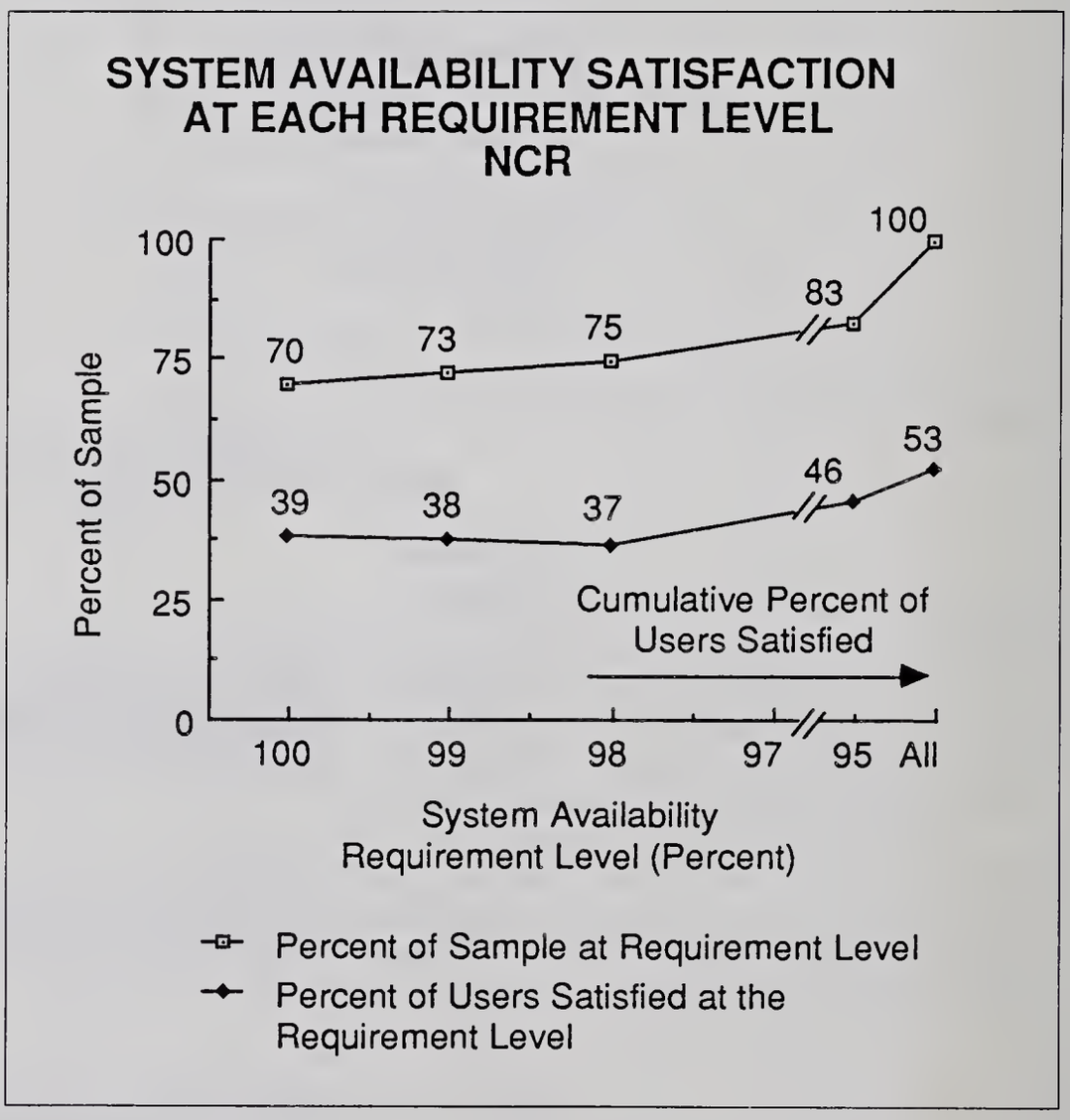
A surprisingly large percentage (70%) of NCR users reported system availability requirements of 100%, as shown in Exhibit IV-71. Typically, such requirement levels are usually reserved for large systems from IBM, NAS, and Amdahl, and fault-tolerant systems and parallel processing systems from Tandem, Stratus, and Concurrent Computer Corporation. At the same time, 25% of the NCR 9300 systems users reported system availability requirements of 98% or less. Such a wide range of system availability requirements within a single product line makes it more difficult for a service vendor to satisfy a large percentage of users than when users have similar expectations for service.

EXHIBIT IV-71



NCR service performance in the area of hardware maintenance can also best be described as uneven. Exhibit IV-72 indicates that NCR users report highest requirements for HW engineer skill level and HW maintenance overall (with average requirement ratings of 9.2); actual performance ratings were at 8.6. Although NCR manages to satisfy the majority of users in these two areas, Exhibit IV-73 suggests that a more-critical area of concern continues to be the availability of spare parts, where

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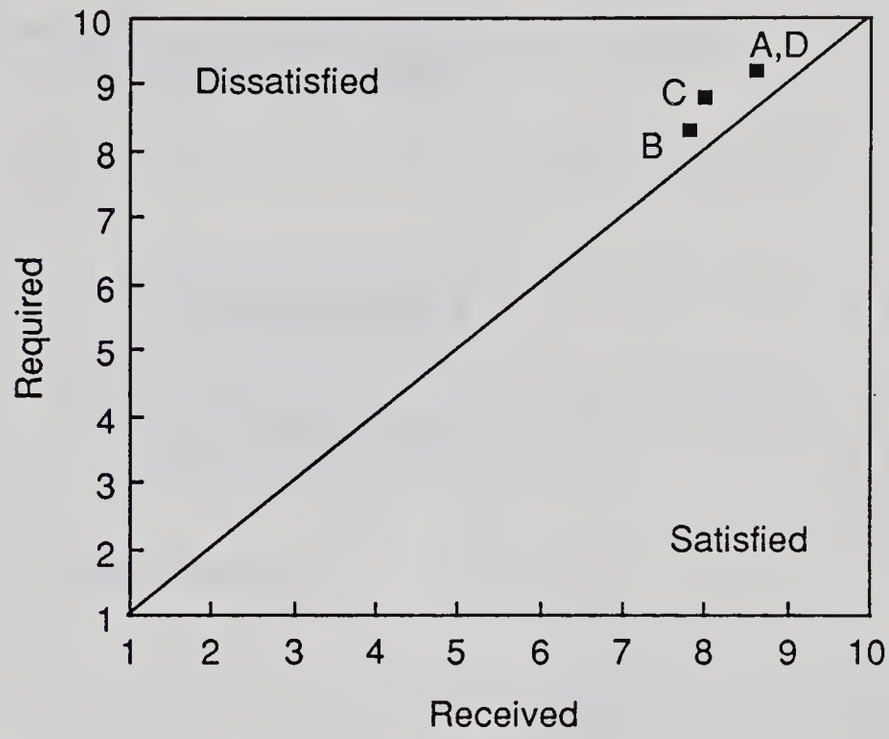
NCR satisfies only 49% of its users. Four NCR users specifically mentioned spare parts availability as their primary service concern.

EXHIBIT IV-72

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED NCR



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	9.2	0.2	8.6	0.2
B	HW Remote Support	8.3	0.4	7.8	0.4
C	Spare Parts	8.8	0.2	8.0	0.3
D	HW Maintenance Overall	9.2	0.1	8.6	0.2

Scale 1=Low, 10=High
SE=Standard Error

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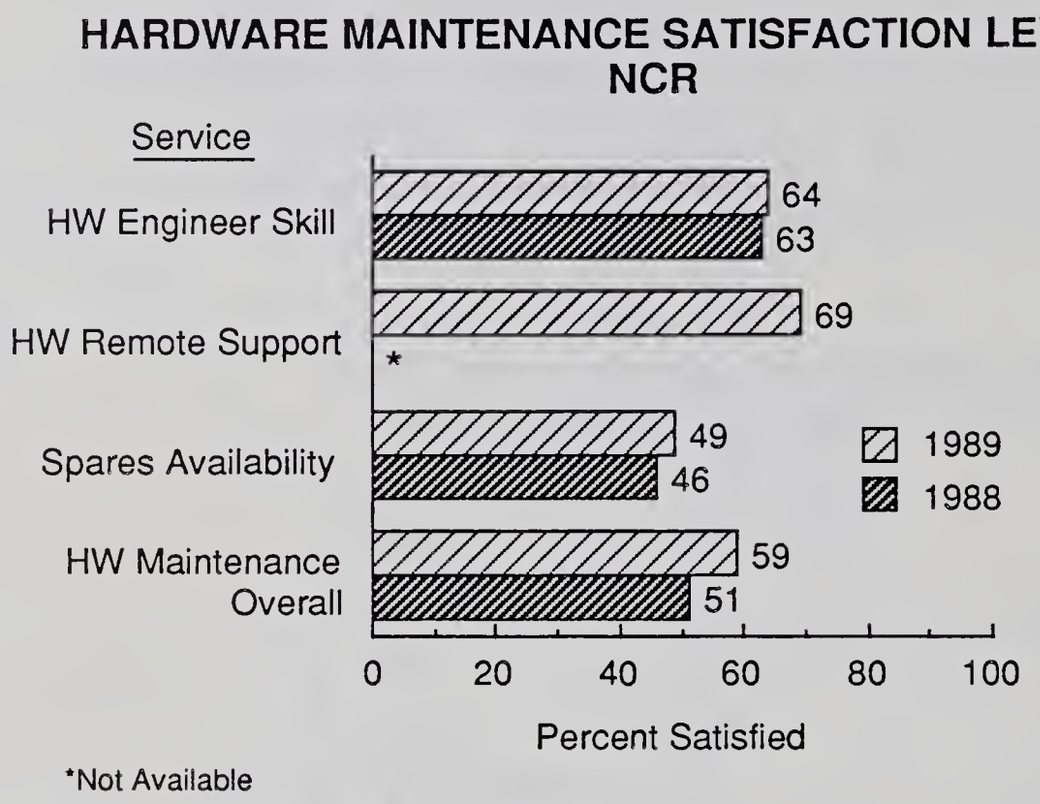
EXHIBIT IV-73



NCR users expressed extremely high requirements for software support services, as shown in Exhibit IV-74, particularly in the areas of SW engineer skill level and SW remote support delivery. Unfortunately, software support performance fell substantially below user expectations. Exhibit IV-75 demonstrates that NCR satisfies fewer than one-third of its users in all software support analyzed, with the exception of operational training (where 53% of NCR users were satisfied).

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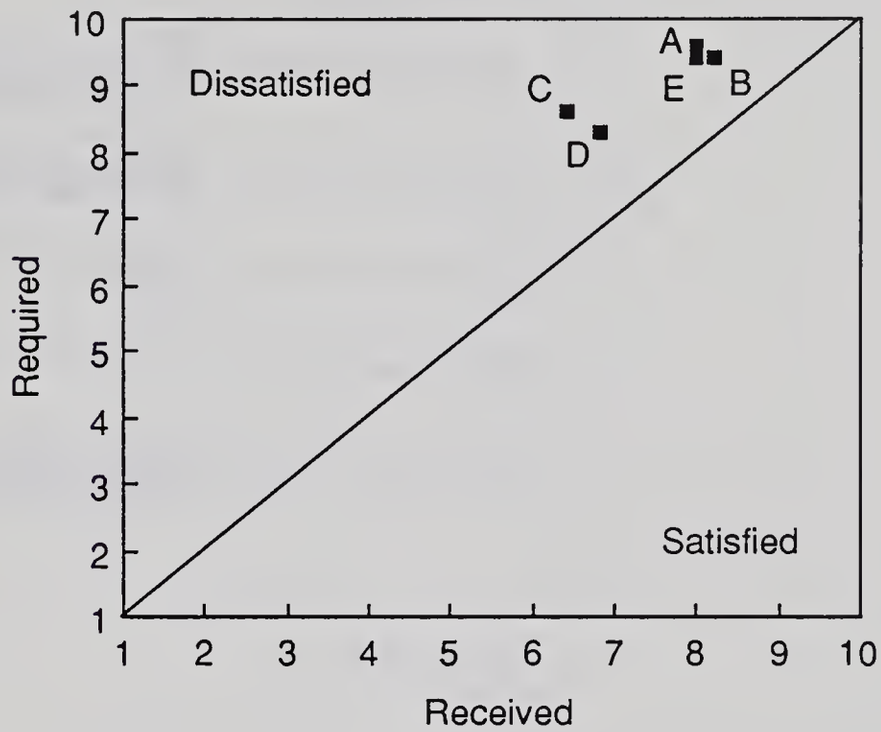
EXHIBIT IV-74

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED NCR



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	9.6	0.2	8.0	0.4
B	SW Remote Support	9.4	0.2	8.2	0.3
C	SW Documentation	8.6	0.5	6.4	0.5
D	Operational Training	8.3	0.6	6.8	0.6
E	SW Support Overall	9.4	0.2	8.0	0.2

Scale 1=Low, 10=High
SE=Standard Error

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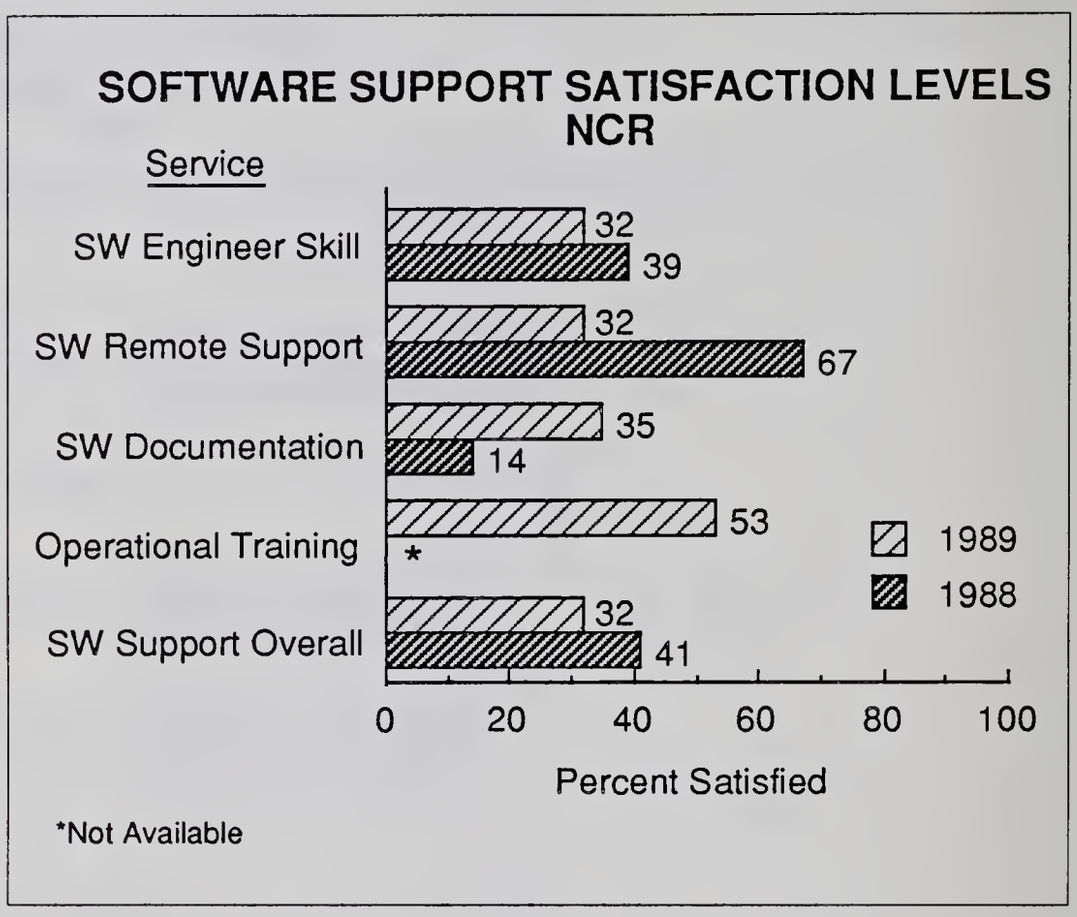
EXHIBIT IV-75



One possible reason for the high expectations for software support is the industry-specific emphasis of NCR systems. Users of such niche-oriented applications found in the banking, manufacturing, and retail industries typically have higher requirements for such value-added services as software support and consulting.

NCR was more successful at satisfying user requirements in the area of ancillary services, as shown in Exhibits IV-76 and IV-77. User satisfaction increased most dramatically in the areas of preinstallation planning (rising from 54% satisfied to 79% in 1989), consulting (from 40% to 67%), and network design and planning (from 50% to 76%). As mentioned earlier, service performance in these areas is much more critical for vendors addressing vertical market applications.

Few third-party maintenance companies currently target NCR large systems; only five 9300 users reported contacts from TPMs in the past year (no TPM vendor was mentioned more than once—TRW was the most recognizable TPM mentioned).

In summary, NCR service strengths are ancillary services, such as preinstallation planning and network design. Areas requiring attention include response time, spare parts availability, and most areas of software support.

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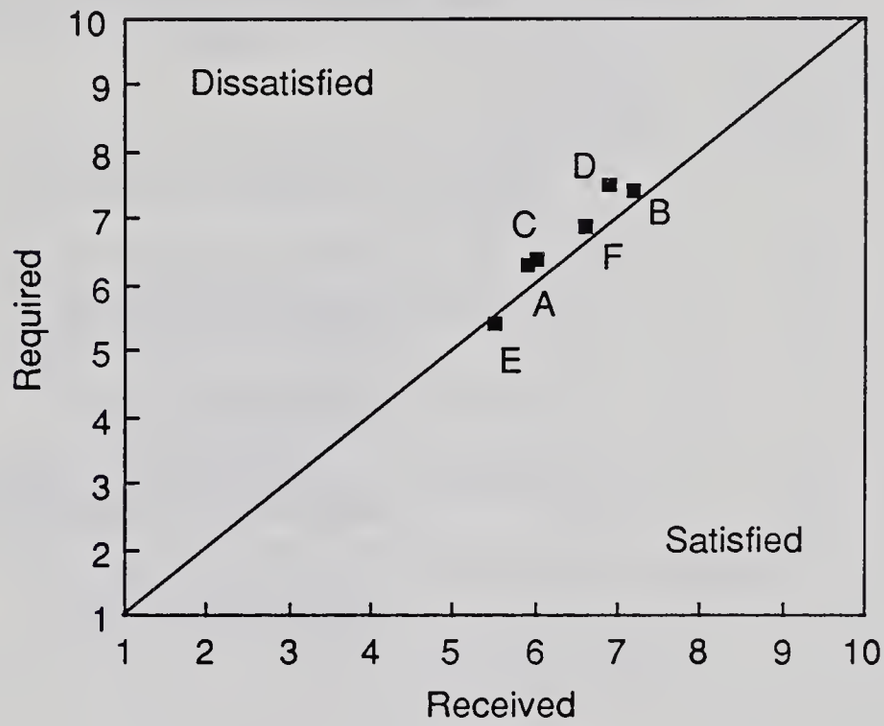
EXHIBIT IV-76

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED NCR



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.3	0.6	5.9	0.6
B	Preinstallation Planning	7.4	0.5	7.2	0.5
C	Consulting	6.4	0.6	6.0	0.5
D	Installation/ Deinstallation	7.5	0.5	6.9	0.5
E	Network Designs/ Planning	5.4	0.7	5.5	0.6
F	Ancillary Services Overall	6.9	0.5	6.6	0.4

Scale 1=Low, 10=High
SE=Standard Error

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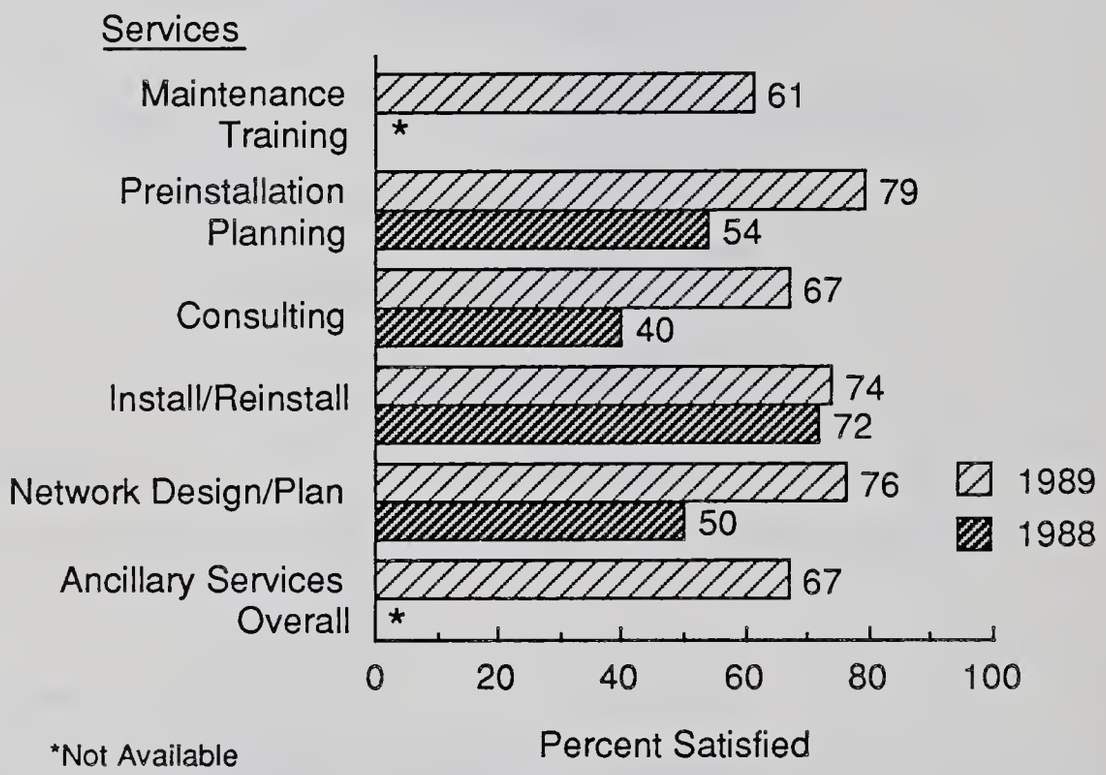
EXHIBIT IV-77



H

Unisys A-Series

In 1989, INPUT surveyed forty users of Unisys A-series mainframes (original Burroughs systems). The sample can be broken down into the following model numbers: thirteen A3s, six A10s, four A4s, four A9s, three A1s, three A5s, three A6s, three A12s, and one A15. The user sample can also be broken down by the following industries: education (10 users); services (9 users); process manufacturing (8 users); state and local government (4 users); banking and finance (3 users); discrete manufacturing (3 users); and medical, wholesale, and other industry-specific (1 user each).

Exhibit IV-78 presents the typical contract coverage reported by the Unisys A-Series users. Predominantly, these users receive a single shift of service coverage (Unisys' normal contract coverage), although one-quarter of the sample opted for seven-day coverage and one-third of the sample selected 24-hour coverage.

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EXHIBIT IV-78

CONTRACT COVERAGE
UNISYS A-SERIES

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	73	62
Monday - Saturday	3	3
Monday - Sunday	24	35
Hours Covered		
1 - 9 Hours	55	42
10 - 16	10	18
16 - 24	35	40

System reliability improved significantly for A-Series mainframe users, according to Exhibit IV-79, which shows that system interruptions per month dropped from 1.7 in 1988 to 0.9 in 1989. Hardware-related failures dropped from 0.9 per month to just under 0.6 per month.

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EXHIBIT IV-79

SYSTEM INTERRUPTION ANALYSIS UNISYS A-SERIES (Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	0.9	0.2	1.7	0.3
Hardware-Caused	62	6.8	55	6.8
System-Software-Caused	11	3.9	16	4.2
Application-Software-Caused	11	4.3	7	2.9
Other-Caused	16	5.0	22	6.3

SE=Standard Error

Unfortunately, average system availability received did not meet requirements, as shown in Exhibit IV-80. Response and repair time actuals dropped significantly in 1989; however, the A-Series users requirements for repair time went from 8.3 hours in 1988 to 2.3 hours in 1989. As shown in Exhibit IV-81, user satisfaction with repair time dropped from 100% (of the 1988 users) to 86% (of the 1989 users).

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EXHIBIT IV-80

SYSTEM AVAILABILITY PERFORMANCE ANALYSIS UNISYS A-SERIES

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	96.8	0.8	96.2	0.7
Response Time (Hrs)	2.2	0.2	1.9	0.2
Repair Time (Hrs)	2.3	0.3	2.3	0.3

SE=Standard Error

EXHIBIT IV-81

SYSTEM AVAILABILITY PERFORMANCE SATISFACTION UNISYS A-SERIES

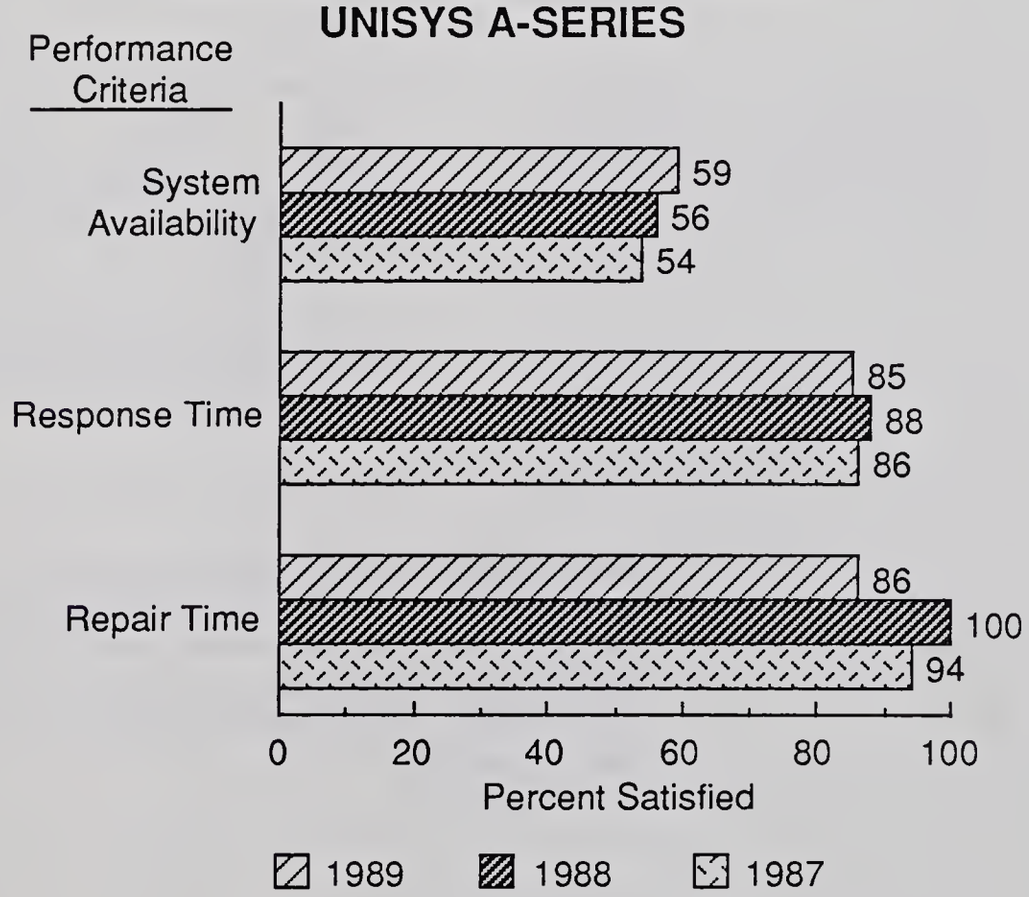

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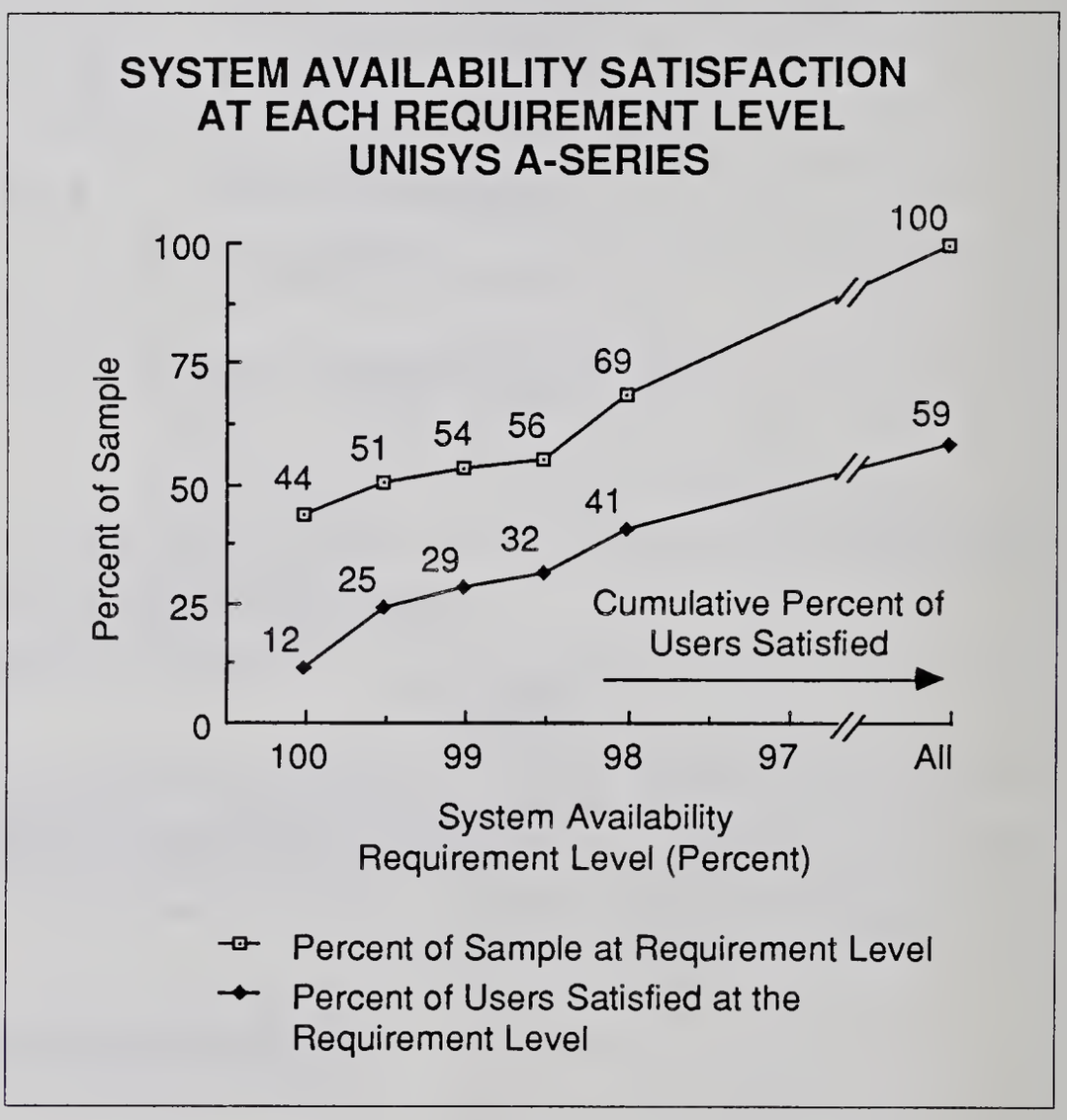
Exhibit IV-82 shows that Unisys is able to satisfy only 12% of users who require 100% system availability (who made up 44% of the sample), and only 41% of users who require 98% system availability or better (69% of the sample). Similar to the NCR sample, Unisys faces a difficult task of trying to satisfy the system availability requirements of a product user base that has widely differing requirements.

EXHIBIT IV-82



Exhibits IV-83 and IV-84 analyze Unisys service performance in the area of hardware maintenance. The A-Series users report mixed results with regard to hardware maintenance services analyzed. Unisys managed to satisfy just over half of the A-Series users regarding hardware maintenance overall, and only 48% of its A-Series users in the area of spare parts availability.

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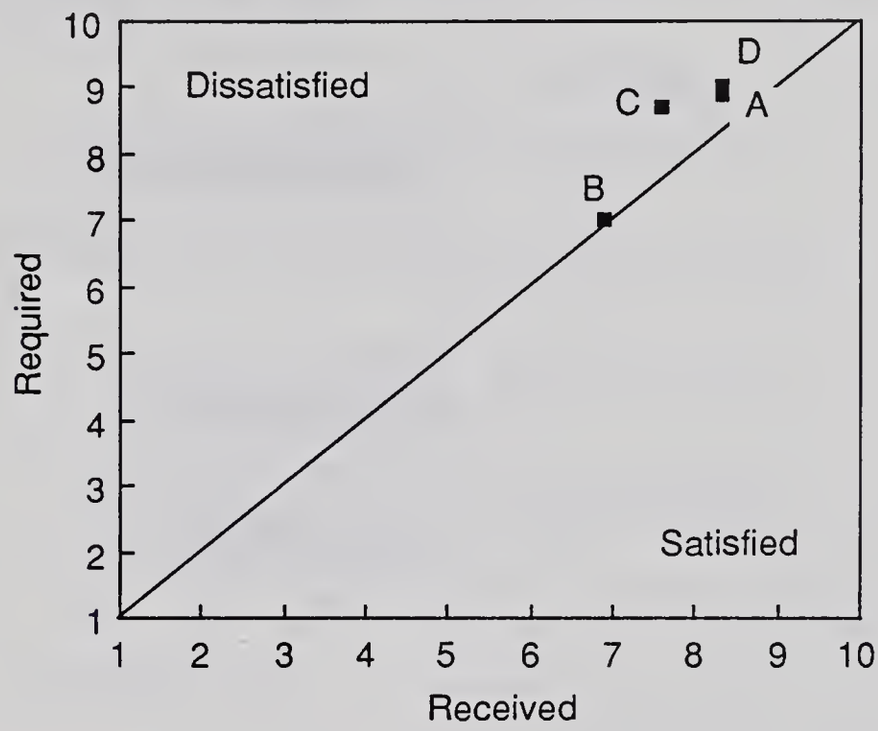
EXHIBIT IV-83

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED UNISYS A-SERIES



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	8.9	0.2	8.3	0.2
B	HW Remote Support	7.0	0.5	6.9	0.5
C	Spare Parts	8.7	0.2	7.6	0.3
D	HW Maintenance Overall	9.0	0.1	8.3	0.1

Scale 1=Low, 10=High
SE=Standard Error

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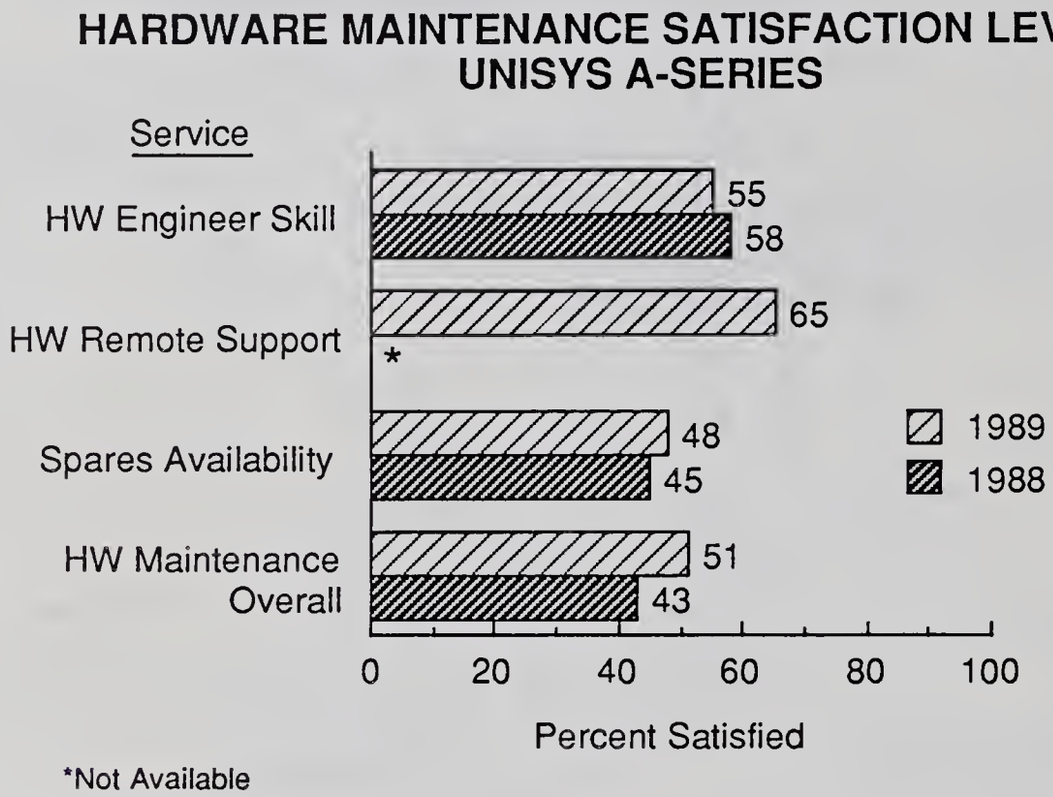
EXHIBIT IV-84



*Not Available

Unisys was slightly more successful at meeting the software support needs of its A-Series users. Exhibits IV-85 and IV-86 indicate that Unisys satisfied 73% of the A-Series users with respect to SW engineer skill level (up from 44% in 1989). This performance undoubtedly helped increase overall user satisfaction with software support (with 59% of the sample satisfied), even though software documentation problems still limit user satisfaction in the software support area.

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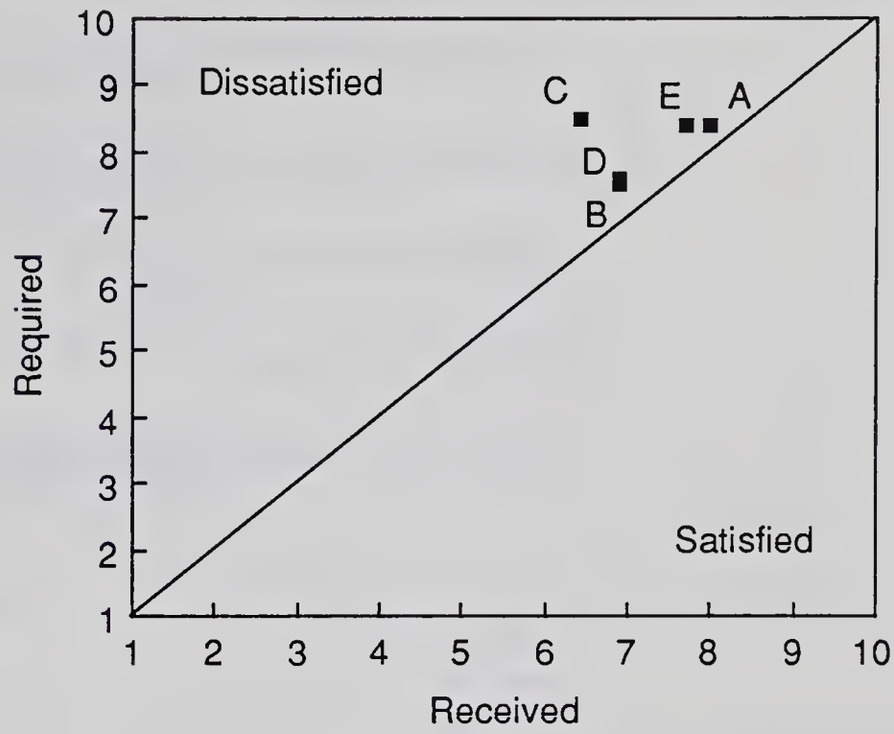
EXHIBIT IV-85

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED UNISYS A-SERIES



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	8.4	0.2	8.0	0.3
B	SW Remote Support	7.5	0.4	6.9	0.5
C	SW Documentation	8.5	0.2	6.4	0.4
D	Operational Training	7.6	0.5	6.9	0.5
E	SW Support Overall	8.4	0.2	7.7	0.3

Scale 1=Low, 10=High
SE=Standard Error

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EXHIBIT IV-86

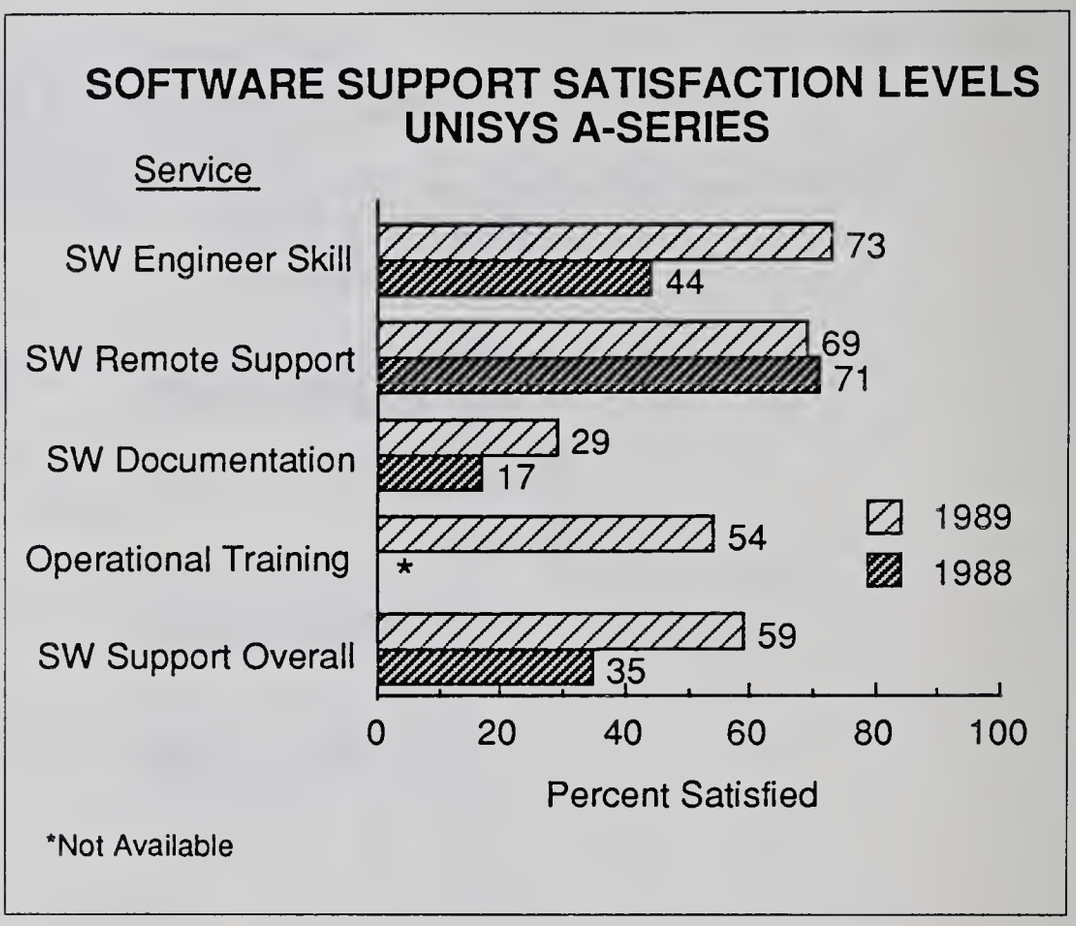

Exhibit IV-87 suggests that Unisys A-Series users place little importance on ancillary services other than installation services. Nonetheless, service performance in these areas is one of Unisys' strong points, as shown in Exhibit IV-88. Unisys scores well in network design and planning (satisfying 73% of the A-Series users), installation services (81% satisfied), and maintenance-related training (88% satisfied).

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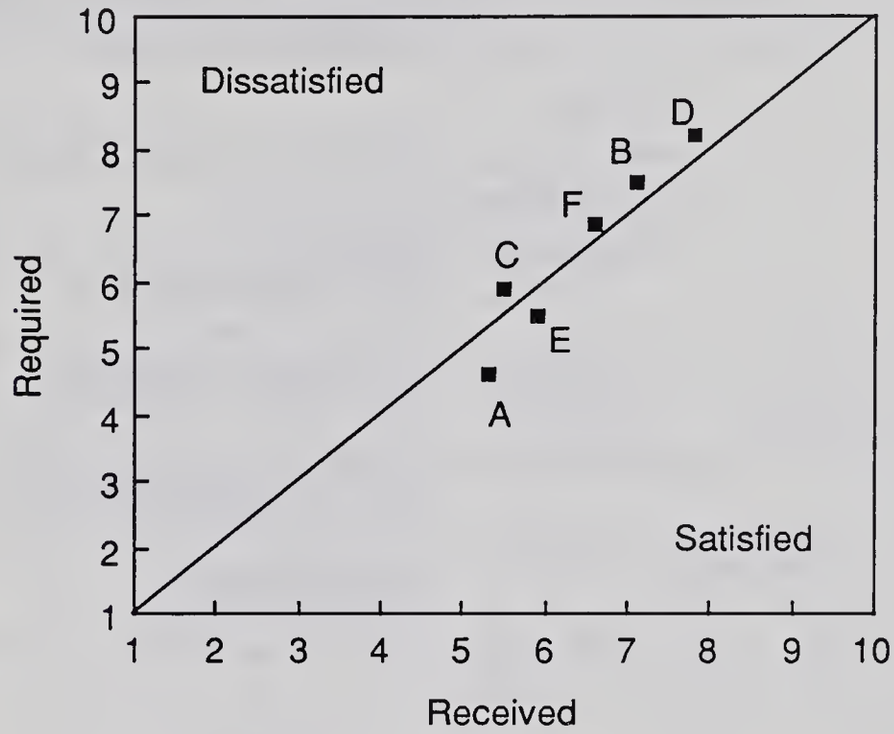
EXHIBIT IV-87

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED UNISYS A-SERIES



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	4.6	0.6	5.3	0.6
B	Preinstallation Planning	7.5	0.4	7.1	0.4
C	Consulting	5.9	0.5	5.5	0.5
D	Installation/ Deinstallation	8.2	0.3	7.8	0.3
E	Network Designs/ Planning	5.5	0.6	5.9	0.6
F	Ancillary Services Overall	6.9	0.4	6.6	0.4

Scale 1=Low, 10=High
SE=Standard Error

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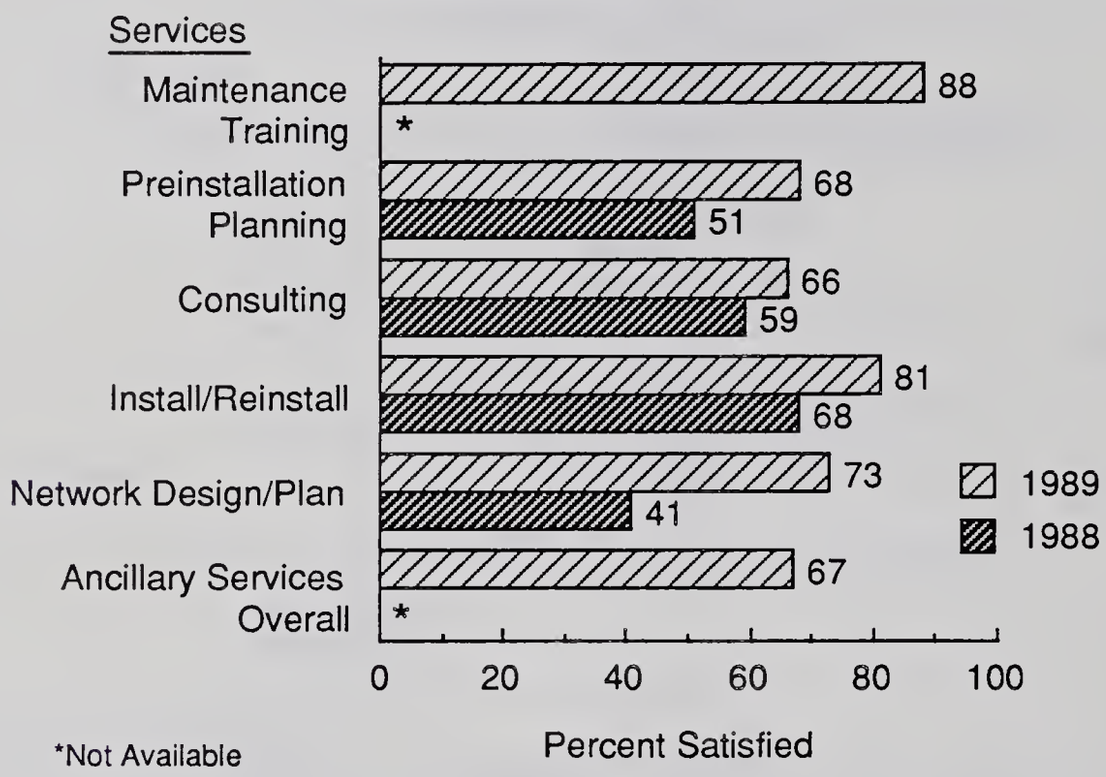
EXHIBIT IV-88



Unisys has not been a traditional market for third-party maintenance. Only five A-Series users reported that they were contacted by TPMs in the past year, with Sorbus the only TPM mentioned.

When queried about their primary service concerns, most users mentioned system availability (mentioned by 16 A-Series users) or parts availability (4 mentions).

In summary, strengths pointed out by the Unisys A-Series users were response time, SW engineer skill level, and installation services. Areas requiring attention include parts availability and software documentation.

I

Unisys 1100/XX

In 1989, INPUT surveyed forty users of Unisys 1100/XX mainframe systems (originally Sperry large systems). This sample can be broken down into the following models: twenty-three 1100/7Xs, nine 1100/9Xs, two 1100/6Xs, two 1100/8Xs, and four unspecified 1100/XXs. Industries represented in the 1100/XX user sample include state and local government (9 users); discrete manufacturing (6 users); process manufacturing

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(6 users); services (5 users); utilities (3 users); retail (3 users); wholesale (2 users); and education, federal government, insurance, medical, telecommunications, and transportation (one each).

Exhibit IV-89 indicates that eight out of ten Unisys 1100/XX users receive 5-day, nine-hour-per-day standard contract coverage.

EXHIBIT IV-89

CONTRACT COVERAGE
UNISYS 1100/XX

	1989 Percent of Sample	1988 Percent of Sample
Days Covered		
Monday - Friday	80	72
Monday - Saturday	0	0
Monday - Sunday	20	28
Hours Covered		
1 - 9 Hours	84	60
10 - 16	5	9
16 - 24	11	31

Exhibit IV-90 shows that system reliability on the 1100/XX systems has improved substantially (from 3.0 system interruptions per month in 1988 to 1.2 per month in 1989). Still, the high number of system interruptions tends to limit system availability. Exhibit IV-91 demonstrates that Unisys response times are quicker than user requirements (and faster than the overall large-system sample), but system availability reported by the 1100/XX users was only 96.9%. Fortunately, the 1100/XX sample reported conservative system availability requirements (perhaps due to the presence of so many state and local government users) and, as a result, Unisys satisfied 68% of the 1100/XX sample, as shown in Exhibit IV-92.

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EXHIBIT IV-90

SYSTEM INTERRUPTION ANALYSIS UNISYS 1100/XX (Percent)

	1989		1988	
	Mean	SE	Mean	SE
System Interruptions per Month	1.2	0.2	3.0	0.6
Hardware-Caused	62	5.7	53	5.4
System-Software-Caused	14	3.7	16	2.9
Application-Software-Caused	5	2.6	10	2.8
Other-Caused	19	5.4	21	4.7

SE=Standard Error

EXHIBIT IV-91

SYSTEM AVAILABILITY PERFORMANCE ANALYSIS UNISYS 1100/XX

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (%)	96.0	1.0	96.9	0.9
Response Time (Hrs)	1.7	0.1	1.4	0.2
Repair Time (Hrs)	2.8	0.4	2.2	0.3

SE=Standard Error

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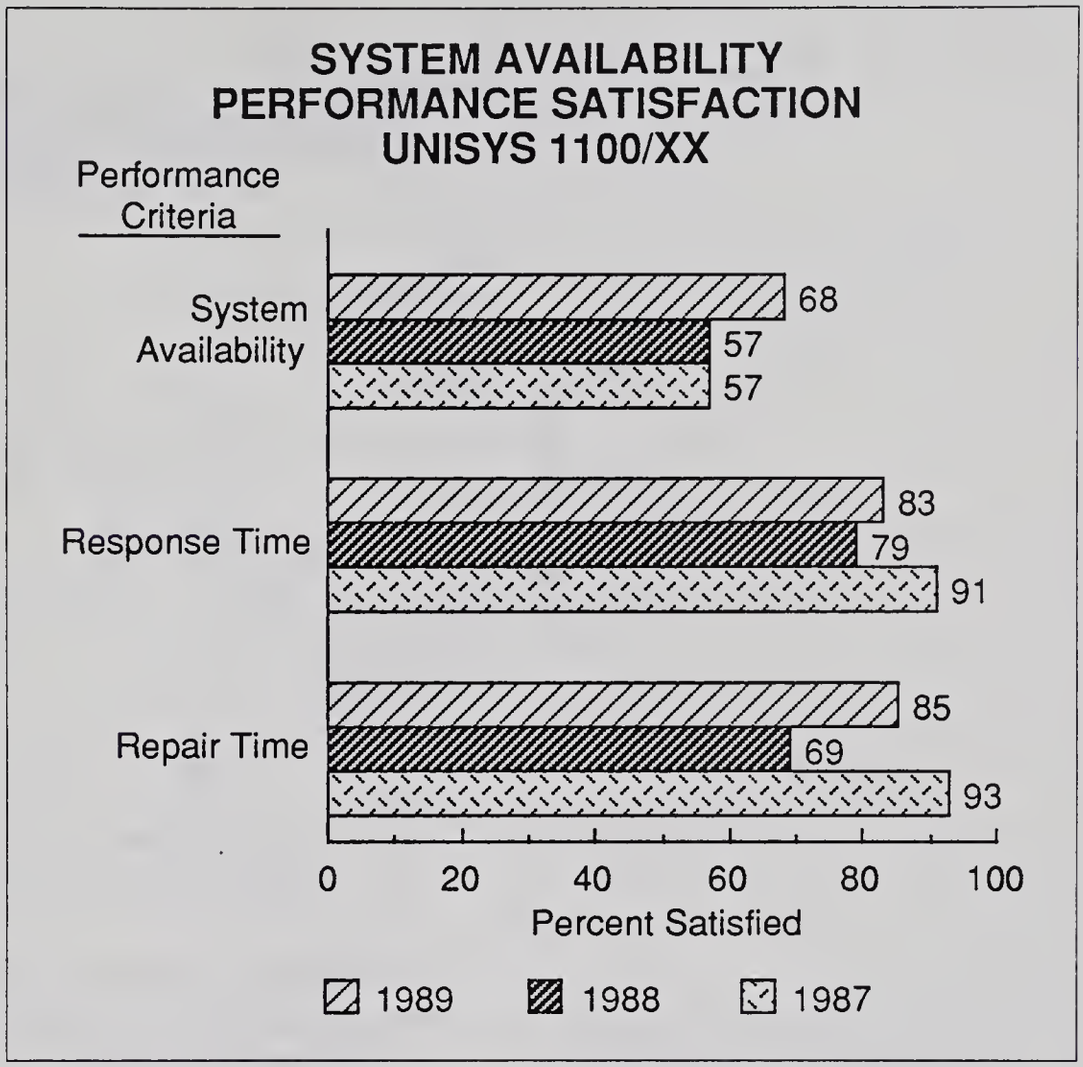
EXHIBIT IV-92



The conservatism of the 1100/XX requirements is also illustrated in Exhibit IV-93, which shows that only 14% of the 1100/XX users required 100% system availability, well below the industry average of 36% requiring 100% system availability.

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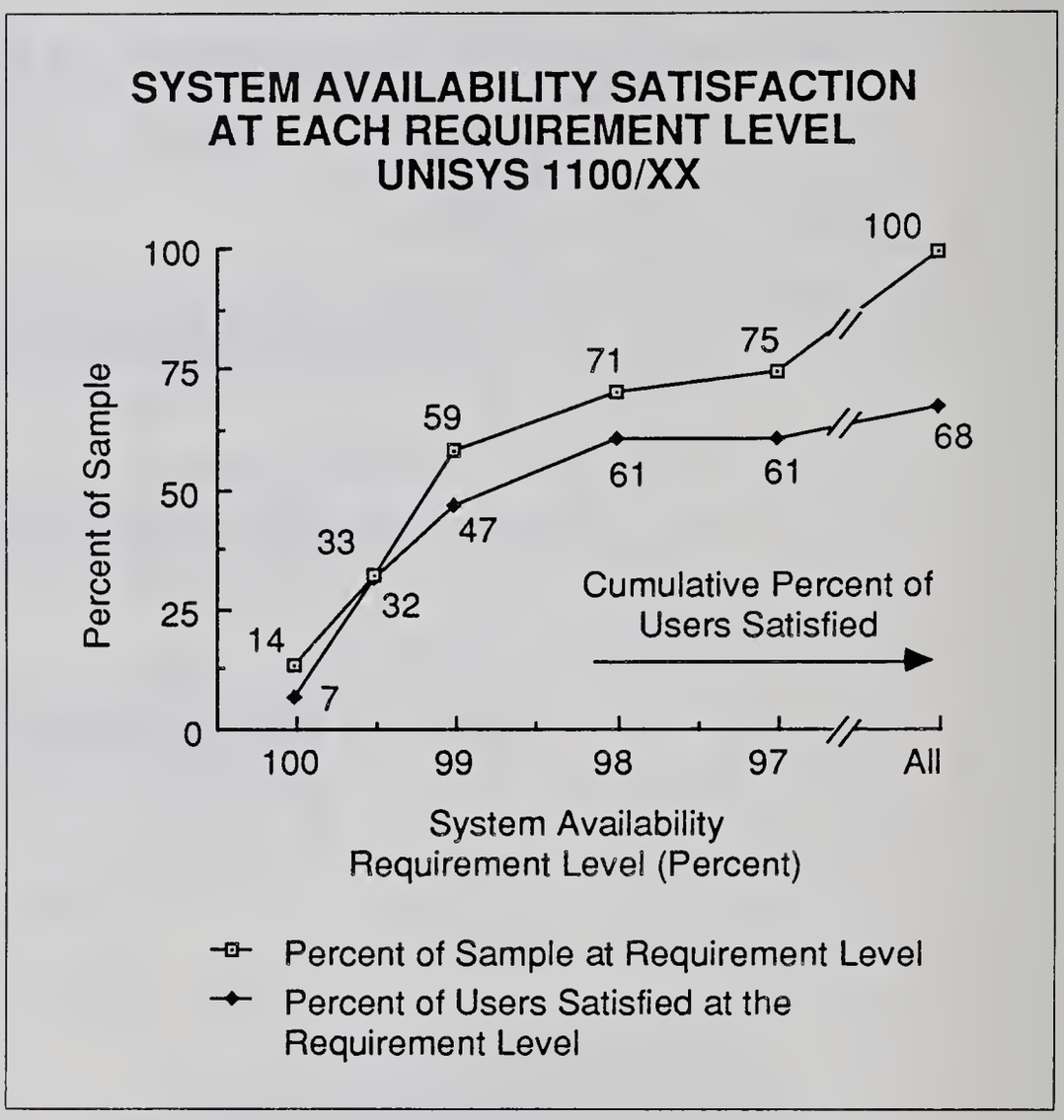
EXHIBIT IV-93



The 1100/XX user sample did report fairly high requirements for the hardware maintenance services analyzed in Exhibit IV-94. As a result, Unisys user satisfaction with all hardware maintenance services measured in Exhibit IV-95 is extremely low, with only 43% of the 1100/XX sample satisfied with HW Engineer skill level, 34% satisfied overall with hardware maintenance received, and only 11% satisfied with spare parts availability.

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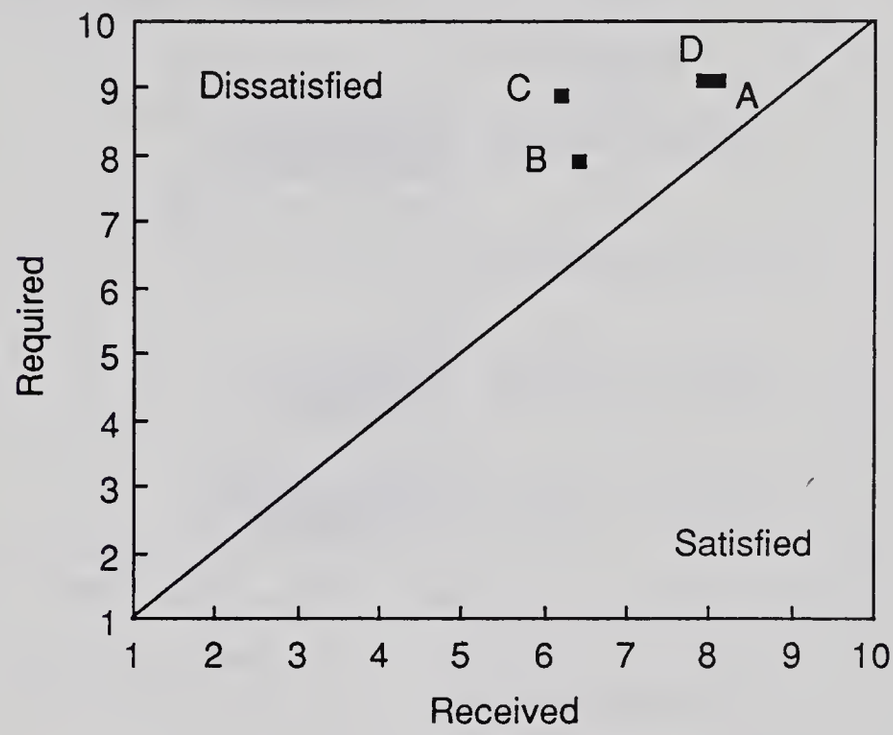
EXHIBIT IV-94

HARDWARE MAINTENANCE REQUIRED VERSUS RECEIVED UNISYS 1100/XX



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	HW Engineer Skill	9.1	0.1	8.1	0.2
B	HW Remote Support	7.9	0.4	6.4	0.4
C	Spare Parts	8.9	0.2	6.2	0.4
D	HW Maintenance Overall	9.1	0.1	7.9	0.2

Scale 1=Low, 10=High
SE=Standard Error

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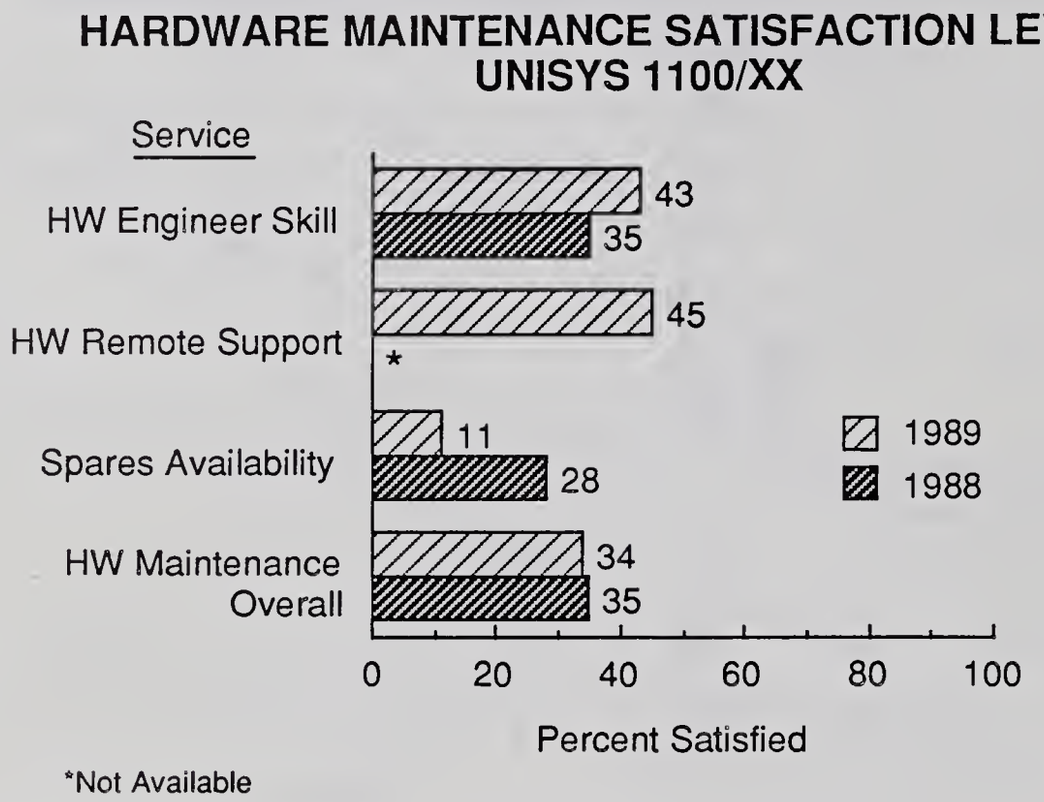
EXHIBIT IV-95



As shown in Exhibit IV-96, the 1100/XX sample also reported extremely high requirements for software support, with four service areas (SW engineer skill level, SW remote support, SW documentation, and SW support overall) having a rating of 9.0 or higher (on a scale of 10) in importance. Unisys software support performance fell well below user requirements; Exhibit IV-97 indicates Unisys failed to satisfy even three out of ten 1100/XX users in 1989.

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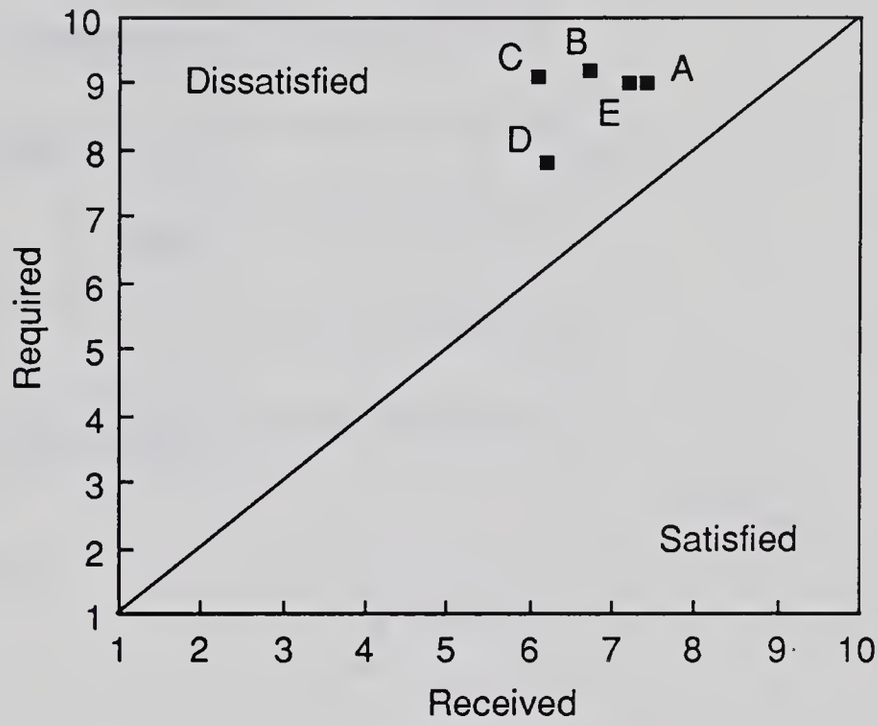
EXHIBIT IV-96

SOFTWARE SUPPORT REQUIRED VERSUS RECEIVED UNISYS 1100/XX



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	SW Engineer Skill	9.0	0.3	7.4	0.3
B	SW Remote Support	9.2	0.3	6.7	0.3
C	SW Documentation	9.1	0.2	6.1	0.4
D	Operational Training	7.8	0.6	6.2	0.5
E	SW Support Overall	9.0	0.3	7.2	0.3

Scale 1=Low, 10=High
SE=Standard Error

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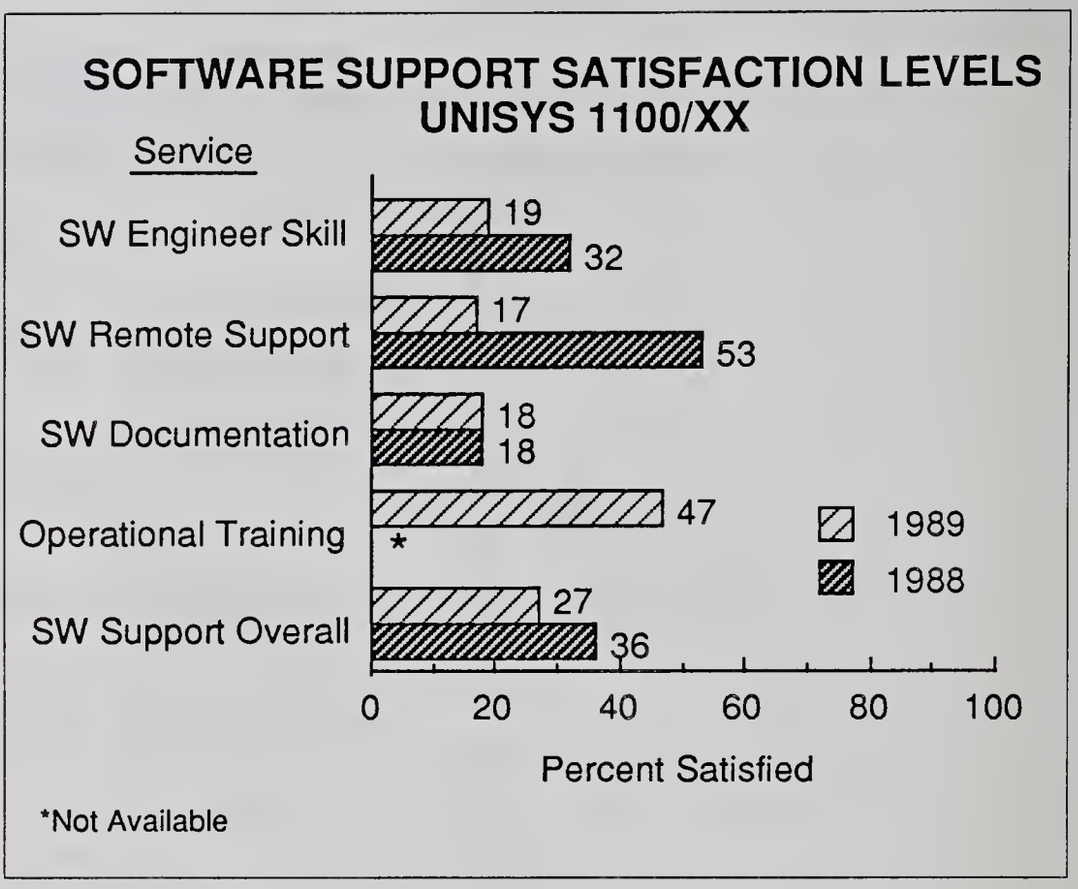
EXHIBIT IV-97



The 1100/XX users also reported moderately high requirements for ancillary services, as analyzed in Exhibit IV-98. Unisys performance can best described as mixed, with respect to ancillary services. Exhibit IV-99 indicates that Unisys scored well in the areas of installation services and ancillary services overall, while at the same time falling short in the areas of consulting and network planning and design.

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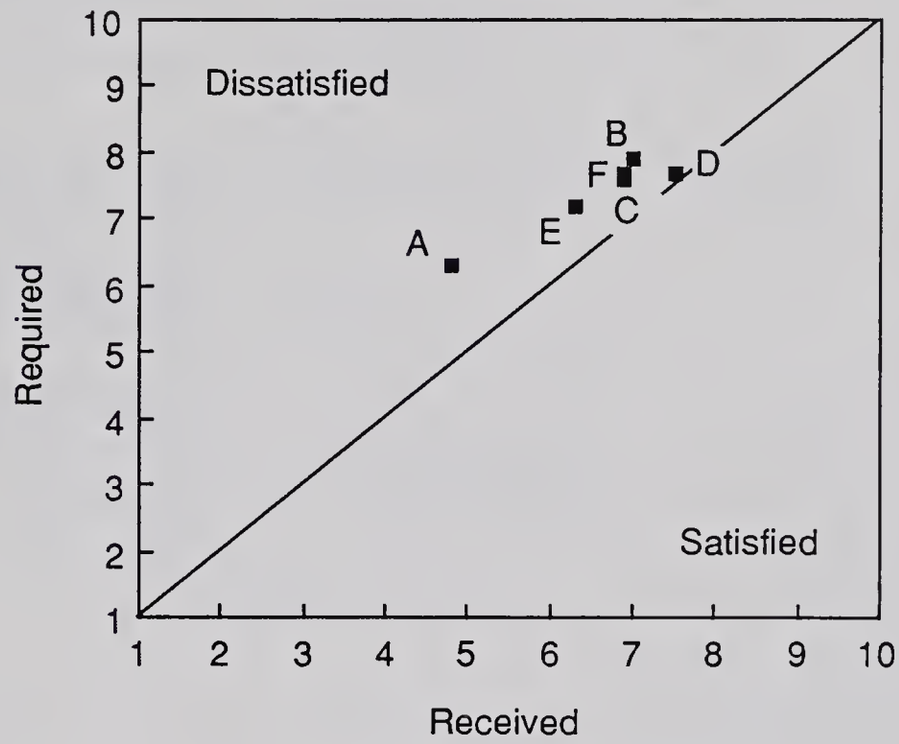
EXHIBIT IV-98

ANCILLARY SERVICES REQUIRED VERSUS RECEIVED UNISYS 1100/XX



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.3	0.7	4.8	0.6
B	Preinstallation Planning	7.9	0.4	7.0	0.4
C	Consulting	7.6	0.4	6.9	0.3
D	Installation/ Deinstallation	7.7	0.5	7.5	0.4
E	Network Designs/ Planning	7.2	0.6	6.3	0.4
F	Ancillary Services Overall	7.7	0.4	6.9	0.3

SE=Standard Error

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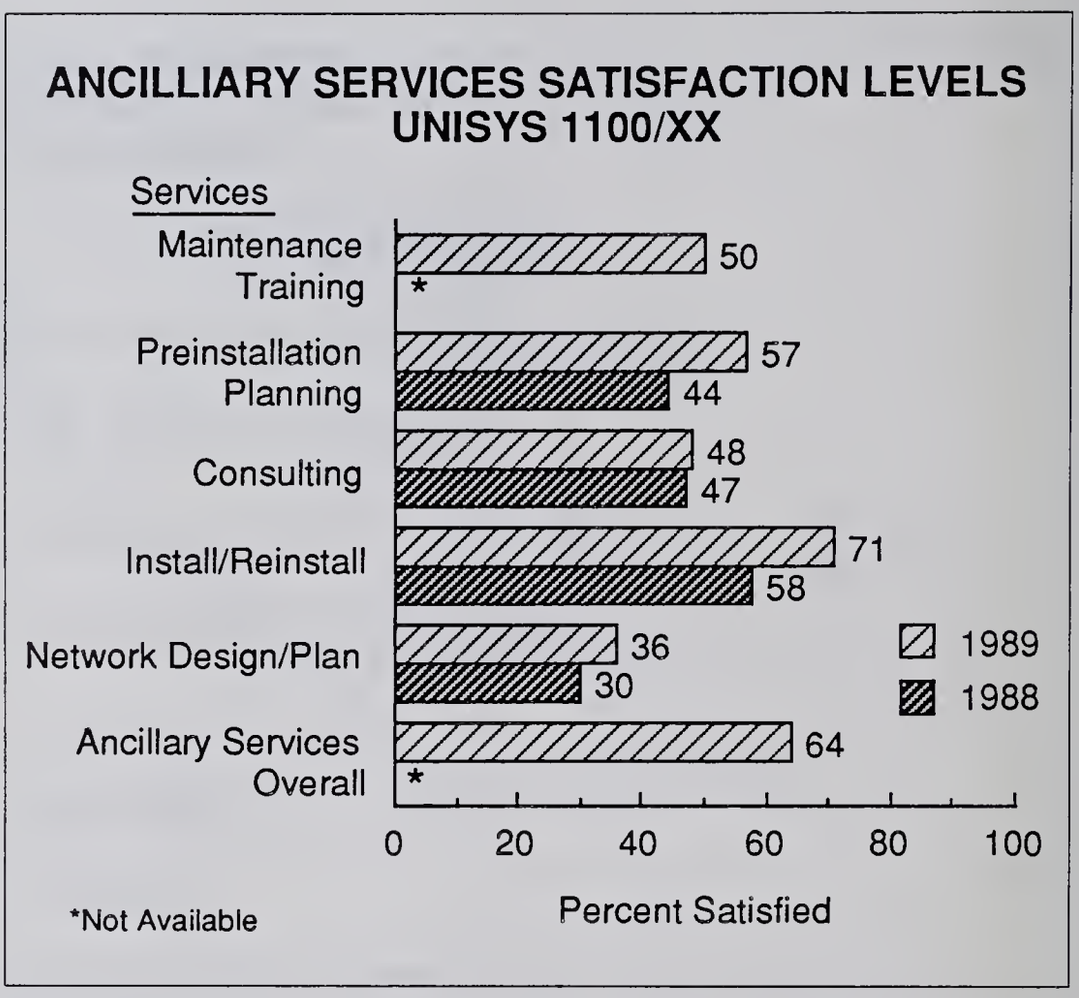
EXHIBIT IV-99



The 1100/XX users reported greater exposure to third-party maintenance organizations than the A-Series systems; 14 users reported that they had been contacted by a TPM in the last twelve months. No TPM was mentioned more than once; the most recognizable TPMs mentioned were Sorbus, CDC, and DPCE.

Spare parts availability and system availability were the most frequently mentioned service concerns reported by the 1100/XX user sample, with 12 and 7 mentions respectively. In addition, three users mentioned FE skill level as their primary service concern. Spares availability was such a pervasive concern that three users felt that on-site or local spare parts would be the one additional service desired.

In summary, strong points of Unisys (1100/XX) service were response time and repair time, while areas requiring immediate concern were most hardware maintenance and software support services, most particularly spares availability, SW engineer skill level, and SW documentation.

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V

Large-Systems Summary Data

V

Large-Systems Summary Data

In this chapter, INPUT presents selected data from the 1989 large-systems user service requirements analysis in summary charts that allow quick comparison of service vendor performance on key service and support items. INPUT would emphasize the importance of the percent-satisfied analyses, since the key to any analysis of customer satisfaction is the vendor's ability to satisfy the specific requirements of its users, rather than the simple attainment of the best individual performance mark, since even the "best" mark will still be lacking if users' requirements exceed it.

Exhibits V-1 through V-11 provide summarized performance data for comparison purposes. For more detailed analysis of the information contained in these tables, please consult the appropriate vendor performance analysis.

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EXHIBIT V-1

LARGE-SYSTEM VENDOR PERFORMANCE SYSTEM INTERRUPTIONS

Vendor	Mean Number Per Month	Percent Caused by:			
		HW	System SW	Applic. SW	Other
Amdahl	0.7	73	13	0	14
CDC	1.0	66	11	7	16
Bull H. N.	1.0	77	16	2	5
IBM 309X	0.7	61	23	4	12
IBM 308X	0.5	51	11	5	33
NAS	0.6	43	27	11	19
NCR	0.6	70	20	2	8
Unisys A-Series	0.9	62	11	11	16
Unisys 1100/XX	1.2	62	14	5	19
All Vendors	0.9	63	16	5	16

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EXHIBIT V-2

LARGE-SYSTEM VENDOR SYSTEM AVAILABILITY

Vendor	System Availability (Percent)		Difference
	Required	Received	
Amdahl	99.0	99.2	0.2
CDC	96.7	97.4	0.7
Bull H. N.	98.0	98.5	0.5
IBM 309X	98.3	98.7	0.4
IBM 308X	98.6	98.8	0.2
NAS	99.2	98.3	(0.9)
NCR	97.4	96.8	0.6
Unisys A-Series	96.8	96.2	(0.6)
Unisys 1100/XX	96.0	96.9	0.9
All Vendors	97.8	97.9	0.1

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EXHIBIT V-3

LARGE-SYSTEM VENDOR RESPONSE TIME

Vendor	Response Time (Hours)		Difference
	Required	Received	
Amdahl	1.5	1.1	(0.4)
CDC	3.5	2.4	(1.1)
Bull H. N.	1.9	1.4	(0.5)
IBM 309X	1.3	1.0	(0.3)
IBM 308X	2.0	0.9	(1.1)
NAS	1.6	1.2	(0.4)
NCR	5.0	6.7	1.7
Unisys A-Series	2.2	1.9	(0.3)
Unisys 1100/XX	1.7	1.4	(0.3)
All Vendors	2.3	2.0	(0.3)

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EXHIBIT V-4

LARGE-SYSTEM VENDOR REPAIR TIME

Vendor	Repair Time (Hours)		Difference
	Required	Received	
Amdahl	2.1	1.7	(0.4)
CDC	3.8	4.1	0.3
Bull H. N.	3.1	2.7	(0.4)
IBM 309X	2.0	2.3	0.3
IBM 308X	2.4	2.1	(0.3)
NAS	2.1	1.7	(0.4)
NCR	4.8	3.6	(1.2)
Unisys A-Series	2.3	2.3	0.0
Unisys 1100/XX	2.8	2.2	(0.6)
All Vendors	2.8	2.5	(0.3)

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EXHIBIT V-5

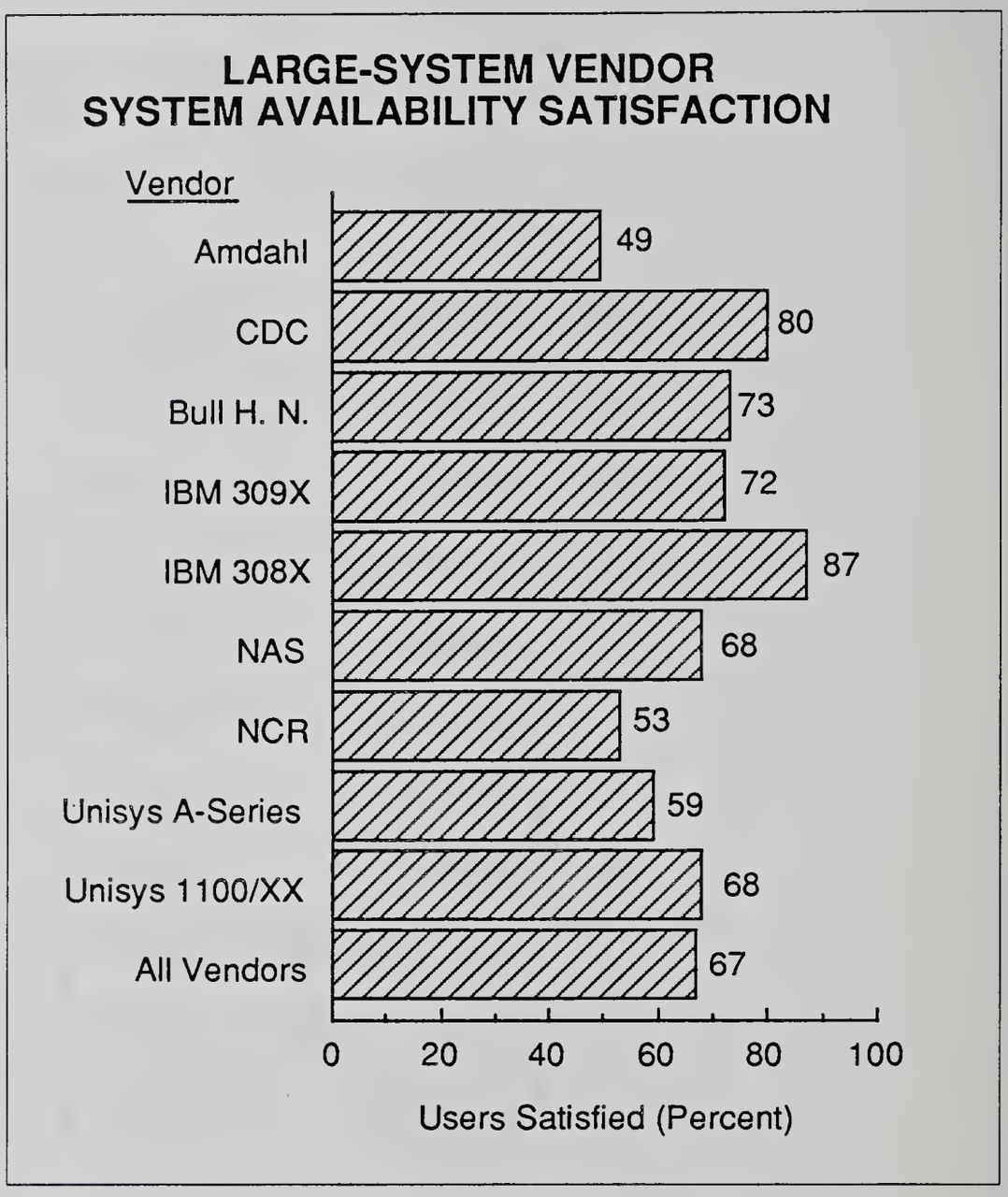

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EXHIBIT V-6

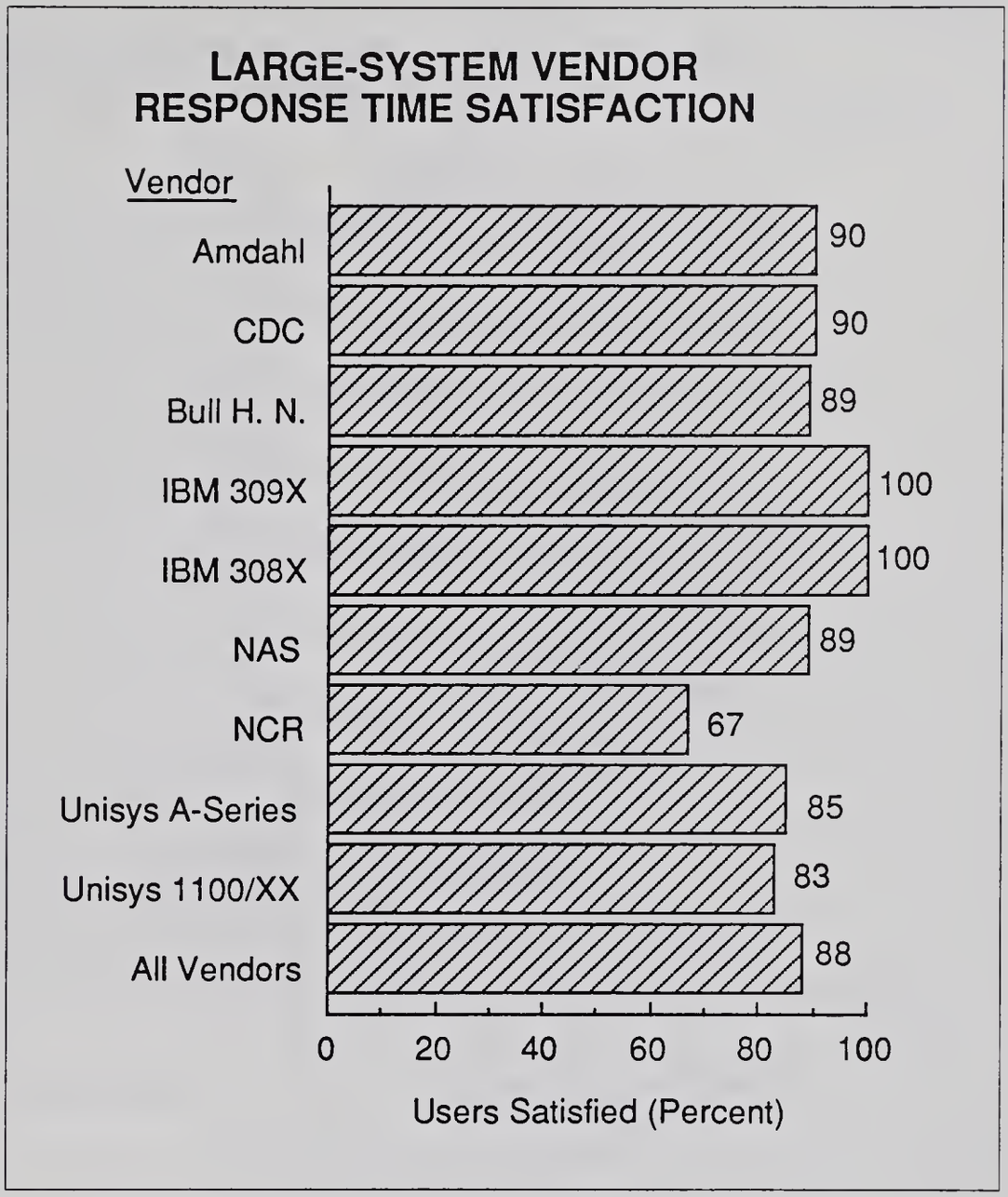

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EXHIBIT V-7

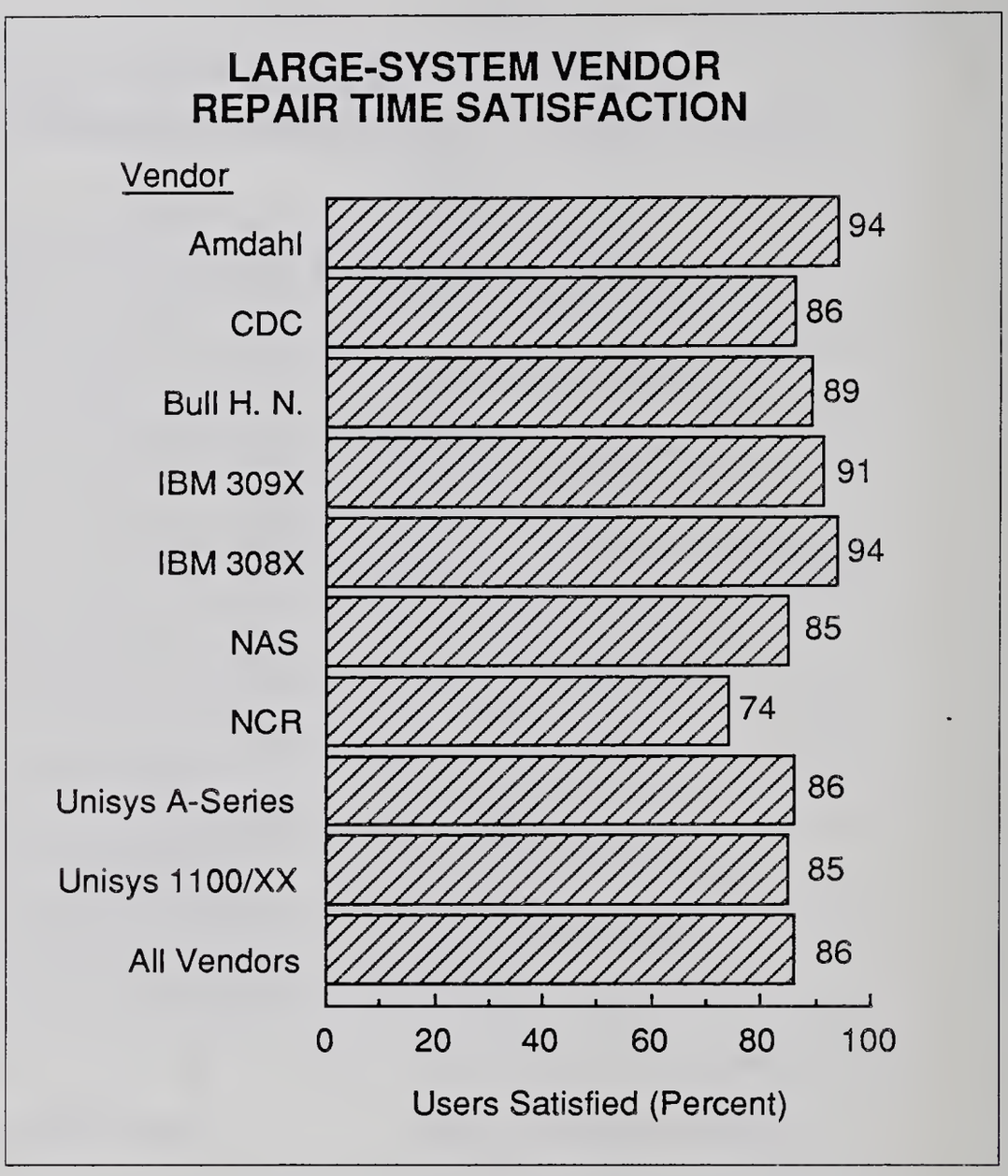

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EXHIBIT V-8

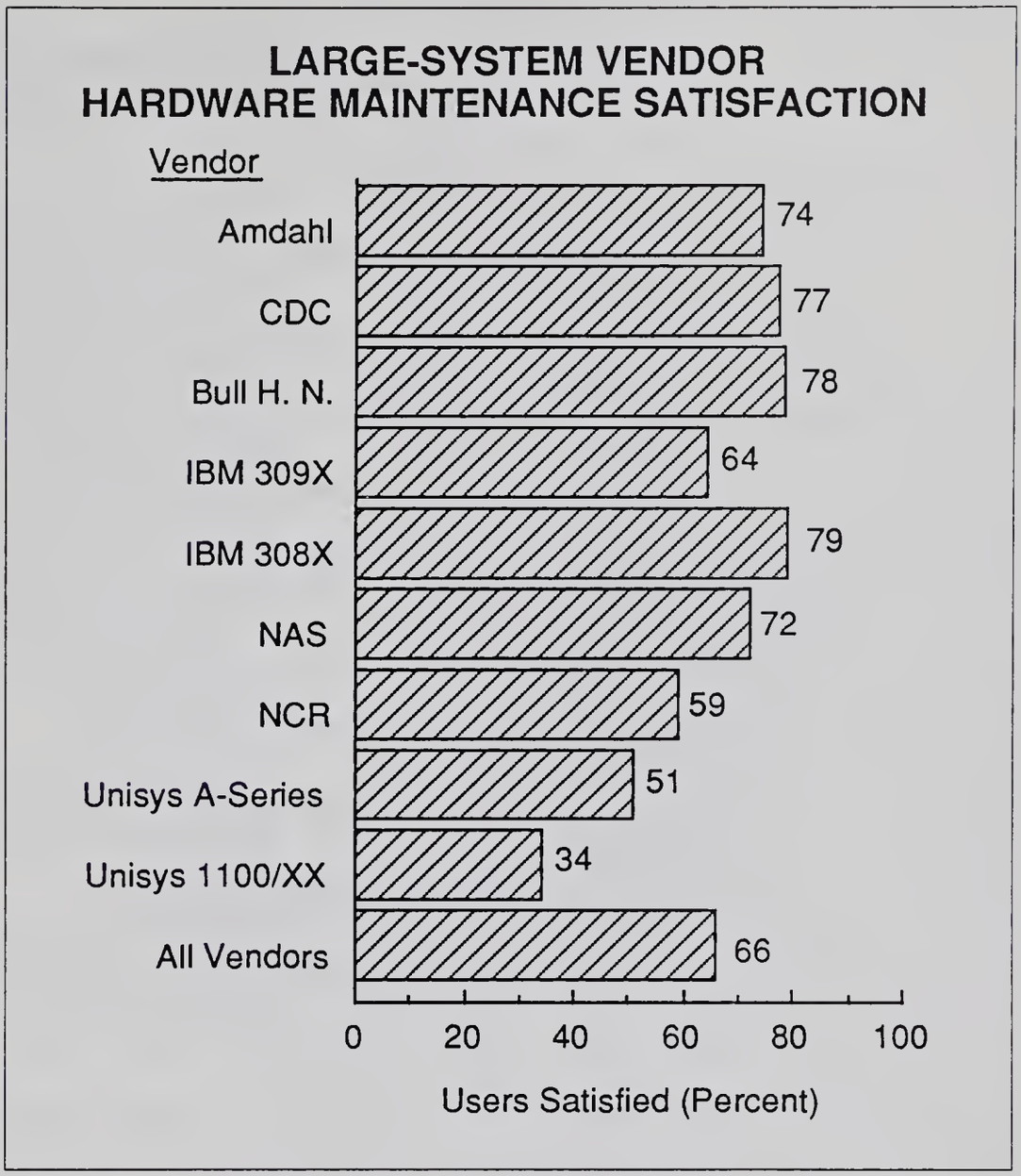

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EXHIBIT V-9

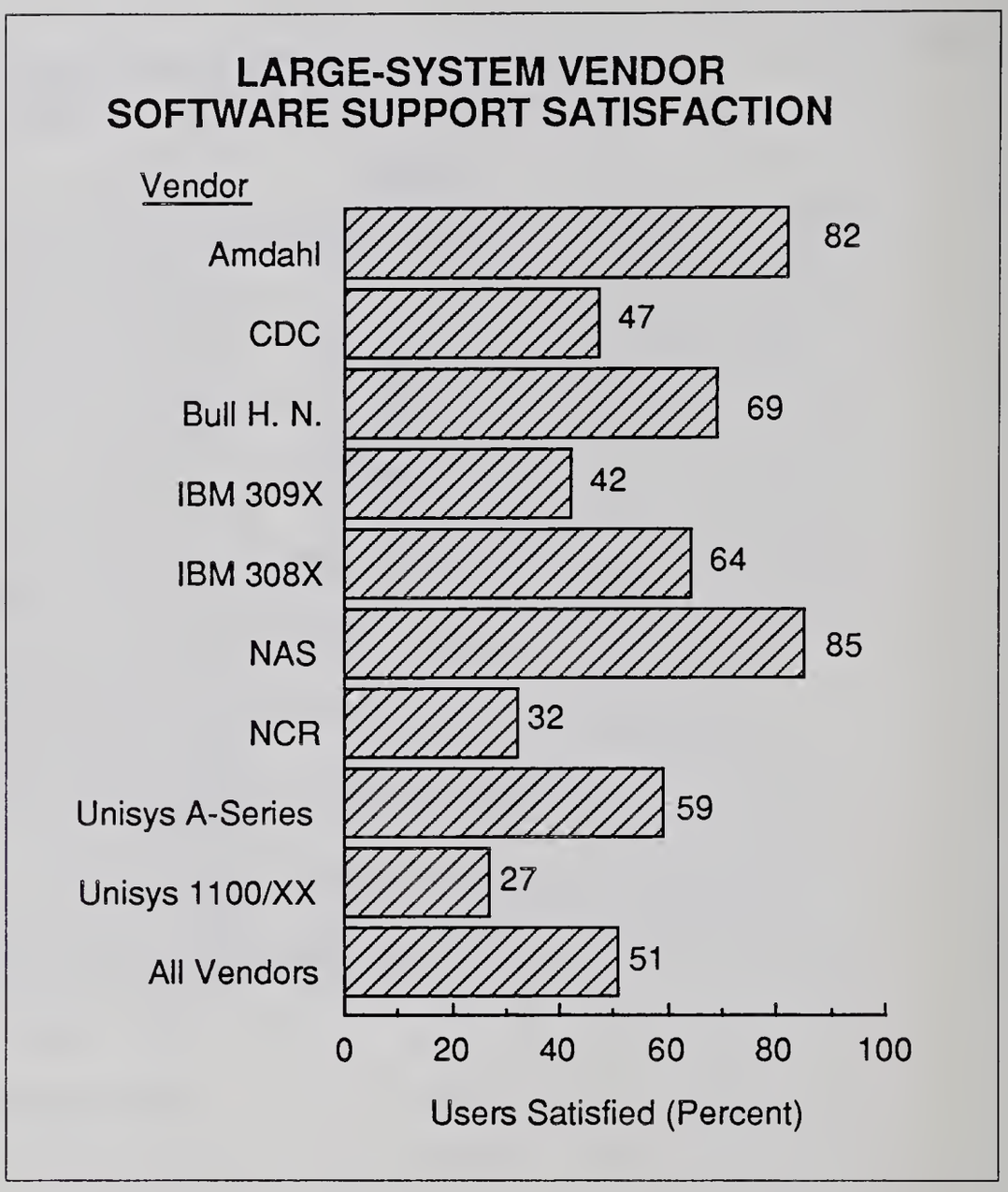

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EXHIBIT V-10

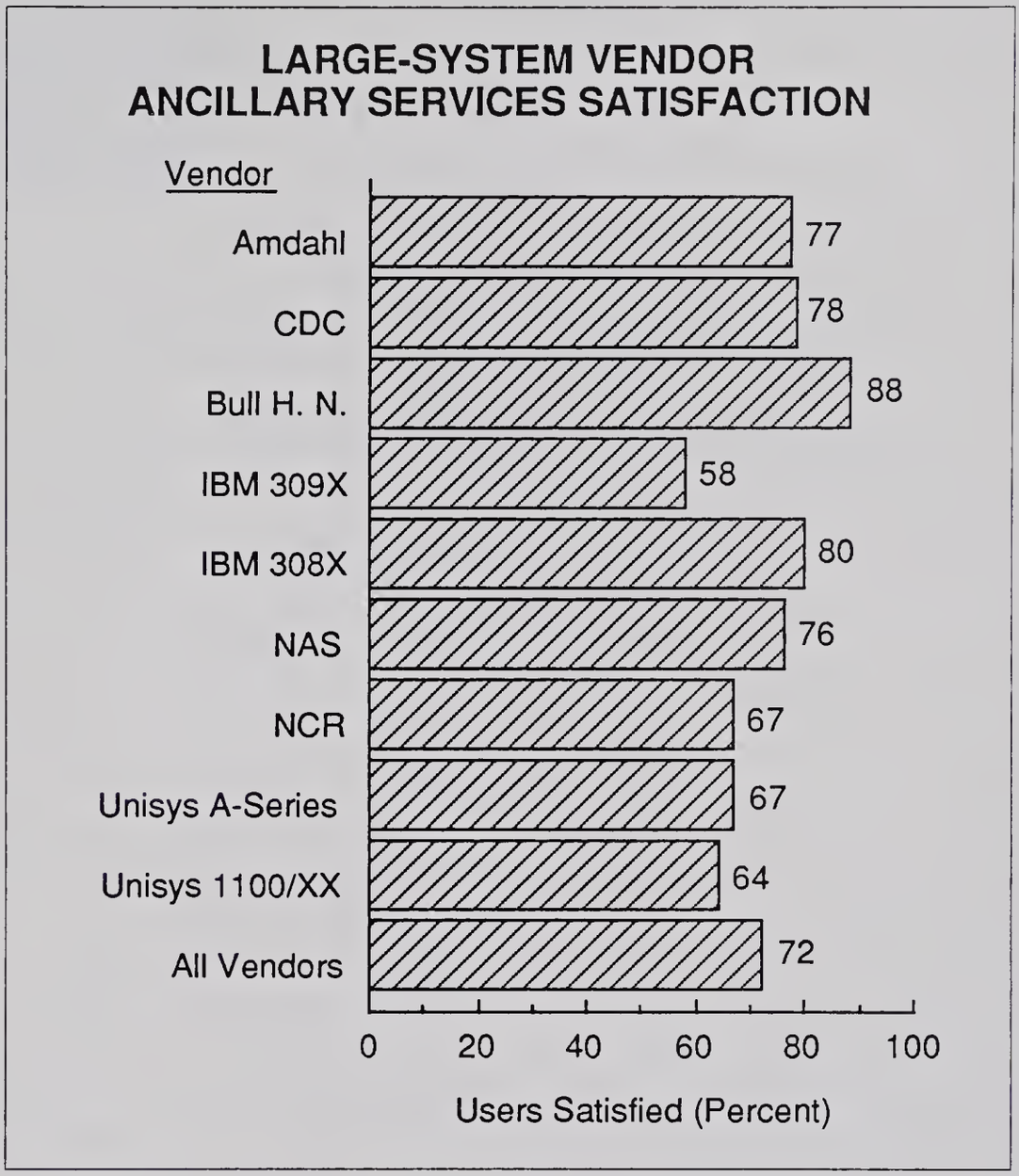

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EXHIBIT V-11

TPMS APPROACHING LARGE-SYSTEMS USERS

TPM	Number of Mentions
Sorbus	40
CDC	21
TRW	10
NAS Spectrum	5
Comdisco	3
Data serv	3
CMC	2
DPCE	2
React	2
Unisys	2
Others	14
Total	104

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A

Appendix: Questionnaire: Large- and Small-Systems User

Appendix: Questionnaire: Large- and Small-Systems User

As listed on "call sheets," confirm with respondent:

1. CPU manufacturer _____

2. Model _____

We'd like to focus our questions on your (manufacturer/model as listed) system. Is that system still in use there? (If no, terminate interview.)

Please keep the service you receive for this system's CPU in mind throughout the survey.

First, some background information:

3. Who provides maintenance service for this CPU? (read list; check one):
   a. The manufacturer ❑
   b. A third-party maintainer ❑

   If third-party maintenance ("TPM"):
   Please specify TPM company: _____
   If third-party, thank respondent and terminate interview here.

4. Regarding the maintenance coverage on this CPU:
   a. Does your contract cover service (read list; check one):
      1) 5 days a week ❑
      2) 7 days a week ❑
      3) Other? (please specify) _____

   b. 1) 8 hours per day ❑
      2) 16 hours per day ❑
      3) 24 hours per day ❑
      4) Other? (please specify) ❑

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Now we'd like to ask a few questions about how you chose your service vendor.

5. I have a list here of different aspects of the service decision. As I read through them, would you please rate the importance of each criterion in the selection of your service vendor?
On a scale of one to ten (ten being highest), what was the importance of (read list):

Factor	Importance (1-10)
a. Price	_____
b. Service quality	_____
c. System availability	_____
d. Response time on a service call	_____
e. Access to spare parts	_____
f. Technical expertise	_____
g. Software support	_____
h. Contract flexibility	_____
i. Ability to service other vendor's products	_____
j. Vendor reputation	_____

Now, some questions about your basic support requirements.

6. Over the past twelve months, how many system interruptions (system failures) did you average per month? _____/month

7. What percent of these interruptions were caused by:

	percent
a. Hardware failure	_____
b. System software	_____
c. Application software	_____
d. Other	_____

(i.e., user error, environmental disruption, etc.) note: total should equal 100%

8. a. What percent system availability ("uptime") do you require? _____
b. What percent system availability do you actually receive? _____

9. Response time being defined as the time it takes a field engineer to arrive at your site after you place a trouble call:
a. What response time do you require? _____ hours
b. What is the average response you receive? _____ hours

10. Repair time being defined as the amount of time it takes on average to have your system up and running after the field engineer arrives:
a. What repair time do you require? _____ hours
b. What repair time do you receive on average? _____ hours

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11. For the following list of hardware maintenance services, can I have you rate (again on a scale of one to ten):
First, the level of service you require; then the level of service you're actually receiving in each area.
Let's start with (read list):

	1. Required	2. Received
	(1-10)	
a. Hardware engineer skill level	_____	_____
b. Hardware remote support	_____	_____
c. Spare parts availability	_____	_____
d. Hardware maintenance overall	_____	_____

12. Do you receive software support from your CPU manufacturer as well? (check one)
Yes _____ (If yes, proceed to question 13.)
No _____ (If no, skip to question 15.)

13. For this software support, please rate your requirements and what you've received in terms of (read list):

	1. Required	2. Received
	(1-10)	
a. Software engineer skill level	_____	_____
b. Software remote support	_____	_____
c. Software documentation	_____	_____
d. Operational training	_____	_____
e. Software support overall	_____	_____

14. Defining a "major" software problem as one in which all processing is prevented, while a "minor" problem allows continued processing with some degradation,
Over the past twelve months:
a. How many major software problems were reported, on average, per month?
_____ /month
b. How many minor software problems were reported on average, per month?
_____ /month
c. What was the average turnaround, in hours (based on 24-hour day), for major problem resolution? _____ hours
d. What was the average turnaround, in hours (based on 24-hour day), for minor problem resolution? _____ hours

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Now, if we can ask a couple questions about support beyond normal maintenance (or ancillary) services:

15. For the following ancillary support services, could you please rate (1-10) your requirement for each service, and then the level of service you're currently receiving?

	1. Required (1-10)	2. Received
a. Maintenance-related training	_____	_____
b. Pre-installation planning services (i.e., environmental, site and installation planning)	_____	_____
c. Consulting	_____	_____
d. Installations/deinstallations/ moves	_____	_____
e. Network design/planning	_____	_____
f. Ancillary services overall	_____	_____

16. Do you currently receive any of the following "multi-vendor" services from your service vendor (check all that apply):
a. Service on other manufacturers' systems (CPUs) _____
b. Service on other manufacturers' peripherals _____
c. Service on other manufacturers' network products _____

17. Do you currently receive any of the following discounts, and if so, can you tell me what percent discount you receive? (read list)

	1. Receive (Y/N)	2. Percent discount
a. Multi-year	_____	_____
b. Pre-payment	_____	_____
c. Call screening/problem management	_____	_____
d. Deferred response	_____	_____

If yes to all (a. through d.) above, proceed to question 19.

18. Regarding those discounts I mentioned that are you not currently receiving: First, on a scale of 1 to 10, how attracted are you to each of these other discount options; and, what percentage discount you would expect for each discount type.
(read only those discounts that respondent said they were not receiving question 17.1 above).

a. Multi-year	_____	_____
b. Pre-payment	_____	_____
c. Call screening/problem management	_____	_____
d. Deferred response	_____	_____

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Finally, we'd like to ask you about your attitudes toward "third-party maintenance," (TPM) (or maintenance done by a specialized service company other than the manufacturer of the equipment).

19. Have you been contacted by a TPM in the last twelve months? (check one)
    Yes _____
    No _____
    If yes, proceed to question 20; if no, skip to 21.

20. Can I ask which TPMs have contacted you, and very briefly, why you didn't opt to switch to their service?

	1. TPM company name	2. Reason
a.		
b.		
c.		

21. At what percentage discount would you be willing to switch to third-party maintenance, if at all? (check one):
    a. 1-10%
    b. 11-20%
    c. 21-30%
    d. 31-40%
    e. 41-50%
    f. 50+%
    g. Unwilling at any discount

That about covers it! Thanks for your patience.

22. To wrap this up, can I ask what you would consider to be your singular most pressing service concern at this time?

23. And, if you could choose one additional service that your vendor is not currently providing, what would that be?

Thanks very much for your time. You've been a great help! To make sure you receive your complimentary report summary, let me check the spelling of your name and the address information (confirm and record on cover sheet).

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B

Appendix: Definitions

B

Appendix: Definitions

Applications Software - Software that performs processing to service user functions.

Ancillary Services - A catagory of services that typically complement hardware maintenance and software support. Examples are install/ reinstall, preinstallation planning, network management,and network design and management.

Artificial Intelligence - The academic discipline involving the study of the processes by which humans perceive and assimilate data (and use reasoning to process this data) for the purpose of duplicating these processes within computer systems. Also, this term refers to the computer systems that accomplish these duplicated processes.

BOC - Bell Operating Company.

Consulting - Includes analysis of user requirements and the development of a specific action plan to meet user service and support needs.

Dispatching - The process of allocating service resources to solve a support-related problem.

Divestiture - The action, stemming from antitrust lawsuits by the Department of Justice, which led to the breakup of AT&T and its previously owned local operating companies.

Documentation - All manuals, newsletters, and text designed to serve as reference material for the ongoing operation or repair of hardware or software.

End User - May buy a system from the hardware supplier(s) and do own programming, interfacing, and installation. Alternatively, may buy a turnkey system from a systems house or hardware integrator.

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Expert Systems Applications - Applications for expert systems—a computer system based on a data base created by human authorities on a particular subject. The computer system supporting this data base contains software that permits inferences based on inquiries against the information contained in the data base. Expert systems is often used synonymously with "knowledge-based systems," although this latter term is considered to be broader and to include expert systems within its scope.

Engineering Change Notice (ECN) - Product changes to improve the product after it has been released to production.

Engineering Change Order (ECO) - The follow-up to ECNs that include parts and a bill of material to effect the change in hardware.

Escalation - The process of increasing the level of support when and if the field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.

Fiber Optics - A transmission medium which uses light waves.

Field Engineer (FE) - For the purpose of this study, field engineer, customer engineer, service person, and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

Field Service Management System (FSMS) - A specialized application program that automates some (if not all) of the following activities of a field service organization: call handling, dispatching, parts inventory and tracking, billing, efficiency reporting, and other functions. Ideally, the system accesses one data base from which each function can use and modify data.

Hardware Integrator - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. May also develop control system software in addition to installing the entire system at the end-user site.

ISDN - Integrated Services Digital Network. A proposed standard for digital networks providing transport of voice, data, and image using a standard interface and twisted pair wiring.

LADT - Local Area Data Transport. Data communications provided by the BOCs within local access transport areas (LATA).

Large System - Refers to traditional mainframes including at the low end IBM 4300-like machines and at the high end IBM 308X-like machines. Large systems have a maximum word length of 32 bits and a standard configuration price of $350,000 and higher.

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Mean Time Between Failures (MTBF) - The elapsed time between hardware failures on a device or a system.
Mean Time to Repair - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.

Mean Time to Respond - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.

Microcomputer - A microprocessor-based single- or multi-user computer system typically priced less than $15,000. A typical configuration includes an 8- or 16-bit CPU, monitor, keyboard, two floppy disk drives, and all required cards and cables.

Minicomputer - See Small System.

Operating System Software (Systems Software) - Software that enables the computer system to perform basic functions. Systems Software, for the purposes of this report, does not include utilities or program development tools.

PBX - Private Branch Exchange. A customer premises telephone switch.

Peripherals - Includes all input, output, and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.

Planning - Includes the development of procedures, distribution, organization, and configuration of support services. For example, capacity planning, "installation" planning.

Plug-Compatible Mainframe (PCM) - Mainframe computers that are compatible with and can execute programs on an equivalent IBM mainframe. The two major PCM vendors at this time are Amdahl and National Advanced Systems.

Professional Services - A category services including system design, custom programming, consulting, education, and facilities management.

RBOC - Regional Bell Operating Company. One of seven holding companies coordinating the activities of the BOCs.

Remote Diagnostics - Gaining access to a computer from a point physically distant from the computer in order to perform problem determination activities.

Remote Support Implementation - An extension of remote diagnostics where some level of support delivery is performed from a point physically distant from the computer. Currently, this capability is more com-

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mon to software support where problems can be solved or circumvented through downline loading of new code (fixes).

Reseller - A marketing organization which buys long-distance capacity for others at wholesale rates, selling services at retail but discounted prices and profiting on the difference.

Small Business Computer - For the purpose of this study, a system which is built around a Central Processing Unit (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT workstations, and offers business-oriented systems software support.

Small System - Refers to traditional minicomputer and superminicomputer systems ranging from a small multi-user, 16-bit system at the low end to sophisticated 32-bit machine at the high end.

Software-Defined Network - A private network which uses public network facilities and which is configurable on an as-needed basis by the user (see Virtual Private Network).

Software Engineer (SE) - The individual who responds (either on-site or via remote support) to a user's service call to repair or patch operating systems and/or applications software.

Software Products - Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

Superminicomputer - See Small System.

Systems Integration - The action of a single service vendor's design, development, and implementation of a system or subsystem including integration of hardware, software, and communications facilities for a customer.

System Interruption - Any system downtime requiring an Initial Program Load (IPL).

Systems House - Integrates hardware and software into a total turnkey system to satisfy the data processing requirement of the end user. May also develop systems software products for license to end users.

T-I - Refers to a standard I.544 megabit per second digital channel used between telephone company central offices and now used for microwave, satellite, fiber optics, or other bypass applications.

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Third-Party Maintenance (TPM) - Any service provider other than the original equipment vendor.

Training - All audio, visual, and computer-based documentation, materials, and live instruction designed to educate users and support personnel in the ongoing operation or repair of hardware and software.

Turnkey System - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.

VSAT - Very Small Aperture Terminal. A small satellite dish system, usually using Ku-band frequencies.

Virtual Private Network - A portion of a public network dedicated to a single user.

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